The Role of Alternatives and Strength in Grammar

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Abstract

The present thesis investigates the role of semantic alternatives and logical strength in a number of empirical domains. Firstly, the thesis deals with the semantic contribution of focus on (bound) pronouns (chapters 2-3). The main results are as follows: First, focus on bound pronouns is interpreted by an operator (Rooth 1992b) in the scope of the binding quantifier. Second, contrastiveness is encoded in the semantics of the operator interpreting focus. Third, it is argued that the grammar must allow for the concept of *compositional reconstruction*, which makes it possible to generate more alternatives for focus licensing than would otherwise be available. Lastly, it is suggested that Schwarzschild's 1999 principle of *AvoidF* should be viewed as an instance of *Maximize Presupposition!* following Truckenbrodt (1995).

Chapter 4 deals with intervention effects in German wh-questions. Building on a new empirical generalization, it is suggested that intervention effects are semantic in nature. However, existing semantic proposals such as Beck's 2006 and Kratzer and Shimoyama's 2002 cannot deal with this generalization straightforwardly. Following Chierchia's 2004 analysis of NPI-licensing, it is argued that wh-expressions denote existential quantifiers and introduce domain alternatives. It is suggested that the alternatives of the clausal node differing only in the size of the domains for the existential quantifier must be such that the disjunction of the propositions in the question denotation is equivalent to the ordinary value of the clausal node. In constructions exhibiting intervention effects, the alternatives are not ordered by disjunction, making the question denote the empty set.

Chapter 5 (partly based on joint work with Benjamin Spector) argues for a generalization of Fox's 2000 Scope Economy condition. In particular, it is shown that inverse scope representations are only allowed by the grammar if the resulting interpretation is not stronger

than the interpretation without movement. Moreover, it is argued that the theory of scalar implicatures can be used to account for this generalization. It is suggested that the grammar demands that the surface scope interpretation of a given sentence gets strengthened. Moreover, the inverse scope interpretation is only allowed if it does not contradict the strengthened surface scope interpretation.

Contents

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Chapter 1

Introduction

This thesis investigates how semantic considerations can influence syntactic structure, chapter 5 on the one hand, and why certain syntactic representations do not converge at the semantic interface, chapters 2-4 on the other hand. By doing so, it sides with much recent work that suggests a more integrated picture of syntax and semantics – that is, the division of labor between the component that builds representations and the one that interprets them is the main concern of the present work. Chapter 4, for instance, argues that representations that are blocked for semantic reasons can nevertheless result in strong unacceptability suggesting that a speaker has not only a strong sense of "syntactic grammaticality" but also of "semantic grammaticality".

Two common threads run through the thesis: First, it investigates some consequences of a theory of grammar that makes crucial use of semantic alternatives – that is, alternatives to the meanings of certain syntactic constituents. Second, some key properties of unrelated empirical phenomena are traced back to a common notion of strength. Let me briefly address each of these notions before turning to a more detailed overview of the contents of this thesis.

1.1 Alternatives

In the chapters to come, semantic alternatives are put to use in largely independent empirical domains: They play a crucial role in the analysis of focus (chapters 2-3), the interpretation

of questions (chapter 4), and, if I am on the right track, also in the theory of quantifier scope (chapter 5). Chapters 2-4 address specific empirical problems and strive to show how semantic alternatives can help us understand these problems. The final chapter establishes a particular empirical generalization concerning quantifier scope ambiguities[1] and relates them to the theory of scalar reasoning. In each of these cases, it will be seen that alternatives as used in this thesis share at least the properties stated in (1).

(1) a. The semantic alternative to ϕ with type τ is a set of elements of the same type.

b. The semantic alternative to $[\phi\ \psi]$ with ϕ of type τ and ψ of type $\langle\tau, t\rangle$ is derived by applying each member in the set of alternatives to ψ to each member in the set of alternatives to ϕ.

In this thesis, the semantic alternatives are kept strictly separate from the ordinary meanings. In other words, a multidimensional semantics along the lines of Rooth (1985) is assumed (but cf. the discussion of Kratzer and Shimoyama's 2002 version of Hamblin-semantics in chapter 4 subsection 4.7.1.2). Chapter 3 provides an argument that such a meaning dimension for alternatives is indeed necessary and therefore part of grammar. A side issue of this thesis is that semantic alternatives as introduced above must be distinguished from a second independent notion of alternative, which is used as well here: In chapters 3 and 5 certain principles are introduced that treat complex syntactic structures as alternatives w.r.t. each other. It will be seen, though, that the two independent notions interact in crucial ways.

1.2 Evaluation of strength

The second key property of this thesis is its appeal to a notion of strength. Strength here refers to entailment, in particular asymmetric entailment:[2]

[1] This part is based on joint work with Benjamin Spector.

[2] Here and throughout the thesis we have a generalized notion of entailment in mind:

(i) For A and B of type $\langle\tau, t\rangle$ and any $a_1, ..., a_n$ of type τ, $A \subseteq B$ iff $A(a_1), ..., A(a_n) \subseteq B(a_1), ..., B(a_n)$.

(2) ϕ is strictly stronger than ψ iff $\phi \subset \psi$.

On the one hand, it is argued that placement of focus is guided by a principle that makes reference to strength, namely *Maximize Presupposition* (MP!, chapter 3). On the other hand, it is shown that covert scope shifting operations (CSSO) are also driven by considerations of strength (chapter 5). In the first case it is assumed that the position where focus is put is regulated by a principle that demands the strongest possible requirement on the context. In particular, it is argued that the strength of focus values – that is, the alternatives to a particular meaning derived by replacing a focused constituent with its alternatives – is evaluated by MP!. The stronger the focus value, the better. In the latter case it is argued that a CSSO must not lead to a stronger interpretation. In other words, if the inverse scope interpretation is strictly stronger than the surface scope meaning, the LF necessary to derive the former interpretation is not available. I.e., the CSSO is blocked. It will be seen that the notion of exhaustification, a process that strengthens a particular meaning by negating its stronger alternatives, can be put to use in the explanation of this restriction on CSSOs. Strength can also be seen as playing a particular role in the discussion of intervention effects in wh-questions in chapter 4. It will be shown that only if the alternatives to the denotation of the clausal node of the question are ordered by asymmetric entailment in a particular way, will the requirement argued for – that is, that the disjunction of the propositions in the question denotation be equivalent to the denotation of the clausal node – be satisfied.

1.3 Overview of the chapters

1.3.1 Focus on bound pronouns

Chapters 2-3 are devoted to the investigation of the role of focus on pronouns. Chapter 2, in particular, deals with focus on bound pronouns. Examples such as (3) under the bound reading for both pronouns have proven as problematic for influential theories of focus licensing such as the ones by Rooth (1992b) and Schwarzschild (1999) (cf. Jacobson (2000), Sauerland (2000,

2008)).

(3) Every author submitted his book, and every journalist submitted HIS book

It will be seen that focus on such pronouns cannot be licensed locally, i.e., by looking for instance just at the constituent *his book*. Rather the binder has to be taken into account when evaluating focus. This causes a problem, however. In the theories mentioned the focus on the bound pronoun has the effect that the focus licensing principle requires there to be a verbal constituent denoting a property of the form $\lambda x.\lambda w.x$ *submitted y's book in* w, with y some individual. However, no such property is readily available because the VP in the antecedent sentence denotes the property $\lambda x.\lambda w.x$ *submitted x's book in* w, i.e., it denotes a bound variable reading. Thus the focus on the bound pronoun should not be licensed. An additional problem is that (3) without the focus on the bound pronoun is also grammatical. Since at least Schwarzschild (1999) it has been known that focus is not optional. In particular, if the structure without focus is licensed, the one with focus cannot be licensed, too. This has the consequence that (3) should also be excluded for this reason (cf. Schwarzschild's principle called *AvoidF*). On the basis of novel data, I argue that theories that leave the theory of focus licensing completely as it is by simply changing the semantic contribution of bound pronouns do not address the problem posed by (3) adequately. In particular, it is argued that the co-occurrence of focus on bound pronouns and additive *too* as in (4) causes problems for such theories, as the presupposition of the additive particle cannot be satisfied. Rather I argue that we have to make small adjustments in the way we conceive of focus licensing.

(4) Every director discussed his film, and every PRODUCER discussed HIS film, too

I argue for the following analysis: Assuming Rooth's 1992b semantics for focus, where the $\sim$-operator interprets focus, I suggest that the contribution of the focus on the bound pronoun is evaluated locally – that is, by a $\sim$-operator in the scope of the quantifier. Second, I argue for a theory that allows for more antecedents for focus licensing than Rooth's original theory. In

particular, it is suggested that more values that can be inferred from actual linguistic objects in the discourse can serve as antecedents for focus licensing than in his theory. These additional antecedents are subject to the novel process of *compositional reconstruction*. Third, a new contrastiveness requirement is argued for. This contrastiveness requirement will have the effect that AvoidF does not block F-marks on bound pronouns among other things.

1.3.2 Focus on bound and referential pronouns

Chapter 3 investigates a proposal made by Truckenbrodt (1995) in a related but different context. Following him, I argue that the principle that reduces the number of foci, Schwarzschild's 1999 AvoidF, should be conceived as an instance of MP!. In other words, considerations such as where in the structure an F-mark should be put or whether it could not be dropped at all are subject to a notion of strength. In particular, the process of focus licensing is driven by the preference of grammar to generate the strongest possible requirement on the context. This makes the prediction that different syntactic structures can be compared w.r.t. focus licensing, as long as these structures make the same truth-conditional contribution. This prediction is confirmed by looking at data with focus on pronouns that could in principle be interpreted as either bound or free variables. It is shown that a structure with a free pronoun is in competition with another with binding as far as MP! is concerned. Thus the present theory makes more competitors available for focus licensing than previous theories concerned with that topic such as Schwarzschild's 1999. A detailed comparison of the two theories is then offered.

1.3.3 Intervention effects

Chapter 4 deals with intervention effects in German wh-questions. Beck (1996a) (also cf. Kim (2002)) observes that questions with wh-in-situ expressions lead to degradedness if certain elements intervene between the wh-word and its scope. In (5), it is the DE-indefinite *höchstens zwei Studenten* that seems to cause this effect. In general, negative elements cause intervention effects.

(5) *Wen haben höchstens zwei Studenten wem vorgestellt?
who have at most two students whom introduced

In the literature two types of approaches to data like (5) are found: Either the problem is blamed on a syntactic property of wh-in-situ questions (Beck 1996a), or a semantic reason for the degradedness is invoked (cf. Beck (2006), Kratzer and Shimoyama (2002) a.o.). The general feature of all approaches is that it makes either all quantifiers interveners or none. It cannot do otherwise without stipulation. This is, however, problematic. No intervention effect is detectable in (6) where the potential intervener is an UE-indefinite. The slight degradedness, I show, stems from a negative scalar implicature triggered by the UE-indefinite. If the implicature is cancelled, the question becomes fully acceptable. But theories that make all quantifiers interveners run into complications with data such as (6). On the basis of these data, I suggest that intervention effects are semantic in nature.

(6) ?Wen haben mindestens zwei Studenten wem vorgestellt?
who have at least two students whom introduced
'Who did at least two students introduce to who?'

I therefore develop a novel semantic approach to intervention effects. In this theory, wh-expressions do not need to undergo movement in order to derive a valid question interpretation. The approach is based on the following ingredients: I assume that wh-questions have a Hamblin (1973)/Karttunen (1977) denotation, which means that they denote the set of possible answers. However, this denotation is derived differently in the present approach. Following Chierchia's 2004 analysis of NPI-licensing, I suggest that wh-expressions denote existential quantifiers ranging over certain domains. Moreover, they introduce domain alternatives into the semantic computation. Thereby the clausal node of the question comes to have a set of propositions as its alternative value from which the Q-operator selects those propositions that only have singleton domains for the existential quantifiers denoted by the wh-expressions. However, the Q-operator also requires that the disjunction of these alternatives is equivalent to the ordinary value of the clausal node. This requirement is shown to follow from natural assumptions about

communication. If the alternatives are not ordered in the way required, the question denotes the empty set. I suggest that this results in uninterpretability of the question. In other words, it is shown that whenever a question exhibits an intervention effect, its denotation is the empty set because the alternatives generated are not ordered by disjunction.

It is shown that this theory correctly draws the line between (5) and (6). It is thus empirically more adequate than existing analyses of intervention effects. I, moreover, show that an analysis along the lines of the one suggested in this thesis coupled with Chierchia's analysis of NPI-licensing opens the door to a potentially unified approach to intervention effects in wh-questions and NPI-constructions.

1.3.4 Generalized Scope Economy

The final chapter is in part based on joint work carried out with Benjamin Spector. The first part of the chapter argues for a novel empirical generalization which is a generalized form of Fox's 2000 Scope Economy Condition. The condition is phrased as follows in (7).

(7) *Generalized Scope Economy condition*

A covert scope shifting operation (CSSO) cannot apply if the meaning of the resulting scope is equivalent to or stronger than (i.e. entails) the meaning of the surface scope.

(7) states that a potentially scopally ambiguous sentence only has an inverse scope interpretation if that interpretation is not stronger than the surface scope interpretation. In particular, I argue that the LF that would be necessary to achieve the inverse scope interpretation as a whole is absent in such cases. In other words, the CSSO cannot apply in such situations. (7) is shown to account for many hitherto mysterious scope facts, such as the difference between (8) and (9). (8) has an inverse scope interpretation, because the surface scope interpretation is strictly stronger than the latter. I.e., (7) licenses the necessary CSSO. (9), on the other hand, is scopally unambiguous, because the reverse entailment pattern holds. As a consequence, the CSSO necessary to generate the inverse scope representation is not licensed by the grammar.

(8) Every student of mine didn't show up $(\forall > \neg)\ (\neg > \forall)$

(9) John didn't meet every student of mine $(\neg > \forall)\ *(\forall > \neg)$

It is then shown that the Generalized Scope Economy condition is the correct way to think about data like (8) and (9). In particular, we give evidence that the inverse LF is indeed not generated by the grammar by adducing novel empirical data, in particular from VP-ellipsis. Moreover, counterexamples are discussed and shown to actually support our view of the facts.

In the second part of the chapter, the Generalized Scope Economy Condition is related to the theory of scalar implicatures. It is argued that (9) follows more or less directly from scalar reasoning if (10) is adopted.

(10) *Blocking by Scalar Implicature*

A CSSO cannot apply if the strengthened interpretation of the surface scope entails that the inverse scope interpretation must be false.

In other words, I argue for a view where the inverse scope in (9) is blocked because the strengthened interpretation of the surface scope – that is, the meaning of the surface scope with its scalar implicatures factored in – necessarily makes the inverse scope interpretation false. In particular, I adopt a theory where the hearer of (9) entertains both the surface scope and the inverse scope LF, but there is a deductive system (e.g. Fox (2000), Fox and Hackl (2006)) where the surface scope interpretation gets exhaustified (following Chierchia (2006), Krifka (1995) a.o.). If the outcome contradicts the inverse scope meaning, the hearer of (9) no longer entertains the relevant LF as a possible one. If successful, the view advocated in chapter 5 lends further evidence to the view that logical principles govern language use.

Chapter 2

Resetting alternatives: Focus on bound pronouns

2.1 Introduction

Focus invokes alternatives for the constituent focused. This intuition goes at least back to Jackendoff (1972) and has been formalized and defended by Rooth (1985, 1992b). So in the sentence in (1) focus on *Mary* makes alternative individuals available that John could have kissed. The focus operator *only* says that of all these alternatives it is false that John kissed them, except for the one stated, i.e., Mary.[1]

(1) John kissed only MARY

It seems clear what the alternatives must be like in the case of (1). The alternatives must be a set of individuals – that is, a subset of the domain of quantification.[2] Even at this informal stage,

[1] Throughout capitals indicate focal stress.

[2] In fact this is not entirely obvious. It seems possible to continue (1) as in (i). If indefinites are quantificational, it might be necessary to include non-individuals in the set of alternatives. Even if that were not necessary for (i), however, question-answer pairs like (ii) do seem to suggest exactly this. The wh-word must invoke quantificational alternatives of some sort.

(i) John kissed only MARY. He didn't kiss a man

it seems fairly clear and intuitive that this idea can be extended to cases of focused constituents other than individual-denoting expressions. So for instance, focus can be used to contrast two linguistic objects as in (2). Here we observe that predicate denoting expressions are contrasted, and again we notice that the focus on the verb provides alternatives to the denotation of the verb itself. That is focusing the verb *hugged* provides alternatives of the form {*kissed, hugged,* ...}.

(2) A: John kissed Mary
B: No, John HUGGED Mary

The first one to discuss the particular problems caused by focus on bound pronouns, which are the subject of this chapter, was to my knowledge Sauerland (1998) (also cf. Jacobson (2000), Sauerland (2000, 2008)). Sauerland gives cases of contrastive focus similar to the ones in (3) and notes that focus on the bound pronoun is optional.

(3) a. Every student cut his (own) arm, and every TEACHER cut HIS arm
b. Every student cut his (own) arm, and every TEACHER cut his arm

Consider (3a). There are three questions arising with respect to (3a). First, what are the alternatives for bound pronouns? By analogy with the examples discussed so far, one would be tempted to say that a bound pronoun has individual-denoting expressions as alternatives, because it is of type *e* itself. But note that it itself does *not* denote an individual. Therefore it seems that bound pronouns have alternatives that are different from themselves in nature. As we will see in section 3.3, this assumption leads to complications for current theories of focus licensing. The nature of the problem is the following: Given that the stressed bound pronoun in (3a) has individuals – that is, objects of type *e* – as its alternatives, the meaning of the antecedent pronoun, which is also bound, is not a member of the relevant alternatives. This has the consequence, as we will see, that focus should not be licensed. A second related problem is the following:

(ii) A: Who kissed Mary?
B: EVERYONE did

What does the pronoun in the second conjunct contrast with? It seems that we would like to say that it contrasts with the one in the first conjunct. But since both pronouns are bound, it is not clear how the notion of contrastiveness is to be defined for them. After all bound pronouns lack reference, and it is not straightforward to defend the view that the bound pronoun in the antecedent sentence contrasts with the one in the second sentence. Although it is sometimes claimed that contrastiveness does not play an essential role in the analysis of contrastive focus (Rooth 1992b), I will defend the view that it actually does. A last puzzle arises with respect to the question why focus on bound pronouns appears to be optional, as evidenced by (3). As has been shown by Schwarzschild (1999) focus is usually not optional. A condition is necessary that reduces the number of foci, his AvoidF. Otherwise, cases of so-called overfocusing should be grammatical. The data in (3) stand in contrast to this.

The present chapter proposes the following answers to the three questions asked in the previous paragraph, using a multi-dimensional semantics along the lines of Rooth (1985) – that is, for each constituent there is an ordinary value and a focus value: Bound variables when focused are indeed not part of the alternatives invoked by the focus-mark (F-mark) on them. The set of alternatives contains only meanings with individuals instead of the bound pronouns. When such alternatives are activated, there must be *salient alternatives* in the context that have this form. It is argued that the operator interpreting focus – that is, Rooth's $\sim$-operator – must be inserted locally, i.e., in the scope of the quantifier binding the pronoun. Therefore, the relevant alternatives that must be contextually supplied are predicate-denoting with the bound pronoun replaced by individuals. It is proposed that the antecedent sentence makes such a set of alternatives with individuals instead of a bound variable salient. This will necessitate a relaxation of Rooth's 1992b theory of focus licensing. In particular, it is claimed that the syntactic coindexation with an antecedent constituent allows for more alternatives than Rooth would allow for. I will argue that the system provides for the possibility to derive through a process of *compositional reconstruction* additional salient alternatives that would not be available from the denotation of the antecedent constituent alone. Of course, we will have to make sure that this mechanism does not overgenerate. The optionality of focus on bound pronouns is accounted for by two as-

sumptions: First, if a bound pronoun bears stress, there is a ∼-operator embedded in the scope of the quantifier interpreting the focus on that pronoun, as already said above. Second there is a contrastiveness requirement (Büring (2008), Wagner (2006b) a.o.) which is implemented as a presupposition introduced by the ∼-operator. This contrastiveness requirement will make it impossible to drop the focus on the bound pronoun, as it would not be fulfilled otherwise. In other words, when the ∼-operator is present in the scope of the quantifier, the bound pronoun must be stressed. But when it is absent, focus must be absent from the pronoun as well.

If this is on the right track, the reader will be able to see that the use of a second interpretation value alongside the ordinary value – which corresponds in the present case to the focus value – and the use of operators to interpret foci are essential for the licensing of focus. The reason for this is that operators are necessary that can reset the second interpretation value so that the contribution of the focus on the bound pronoun does not "project" all the way to the root level. In other words, the semantic contribution of focus on bound pronouns must be restricted to the scope of the quantifier.

Lastly, I will compare the present proposal to previous approaches to the problem. In particular, I will show that the revisions just sketched are necessary. Previous proposals to deal with the data in (3), in particular Sauerland (2000, 2008) and Jacobson (2000), face difficulties given two novel empirical observations that are naturally accounted for by the present proposal. Moreover, I address the empirical puzzle in Schwarzschild's 1999 framework and show that it remains a puzzle in that theory as well. By extending the conclusions drawn from the present approach to Schwarzschild's theory, it is suggested that what is needed to fix the problem is a second value for interpretation and an operator interpreting foci that can reset that second value. I provide an implementation of this idea using Schwarzschild's formalism, i.e. givenness checking.

The chapter is structured as follows: In section 3.3, I review the problem posed by (3). I show that these data are indeed problematic for a theory relying on the use of alternatives for focus licensing. I will moreover discuss novel data showing that previous proposals have to be modified. Section 2.3 introduces the proposal defended in the present chapter. Section 4.6

discusses the predictions of the present proposal. In particular, it is shown that it can account for well-known data motivating a condition like AvoidF and does not overgenerate otherwise. Section 4.7 compares the present analysis to other proposals found in the literature aiming at the explanation of (3). We will look in more detail at data that call these approaches into question but are accounted for by the present analysis. Moreover, it is shown that the central puzzle investigated in the chapter also arises in Schwarzschild's theory of givenness. We discuss how the present theory relates to it. Section 2.6 briefly summarizes and discusses the findings of the chapter.

2.2 The problem of contrastive focus on bound pronouns

I will now discuss the particulars of the problem posed by cases like (3) with respect to a theory making use of focus values. In this section, the solutions proposed in the literature are not discussed in detail yet, because I first want to make the problem clear for standard proposals. In the following section, a way is shown how a theory like the one discussed here can be extended to cover the problematic cases. This analysis is then compared in subsection 4.7 to previous proposals found in the literature.

2.2.1 The problem in a theory with focus alternatives

Rooth (1985, 1992b) introduces focus values into the semantic computation (also cf. the discussion in Kratzer (1991) and Beck (2006)): F-marks have semantic content. This means that in addition to ordinary semantic values there are focus values. The former value is the usual denotation of a given constituent ϕ of type τ, which is derived by applying the interpretation function $[\![\ ]\!]^g$ to ϕ without taking F-marks into account. The focus value of constituent ϕ, on the other hand, is the set of its alternative meanings – that is, it is a set of meanings of type τ. These sets are also referred to as p-sets. The focus value of a constituent ϕ without F-mark is equal to its normal denotation, or more precisely to the singleton containing only the normal denotation of ϕ. As Rooth shows the focus value of a constituent ϕ can be defined recursively by taking the

focus values of all subconstituents of ϕ and applying the usual semantic rules to them. Consider (4). (5a) gives the compositional steps for the ordinary values ignoring F-marks. (5b) gives the steps for the focus values, which crucially make use of F-marks. Note in particular that the set of alternatives for *John* is the domain of individuals (5bi). The focus values of *Mary*, *kissed*, and the VP, on the other hand, are equivalent to the respective normal semantic values – that is, to the singletons containing the respective ordinary semantic values.[3] The function denoted by the VP must apply in point-wise fashion to each element in the set of alternatives to *John* (5bv) – that is to each individual in the domain of quantification. The focus value of the whole sentence is therefore a set of propositions, namely the set of propositions of the form *x kissed Mary*, where *x* is an alternative to *John*.[4]

(4) JOHN$_F$ kissed Mary

(5) a. (i) $[\![\text{John}_F]\!]^g = John$

(ii) $[\![\text{Mary}]\!]^g = Mary$

(iii) $[\![\text{kissed}]\!]^g = \lambda y.\lambda x.\lambda w.kissed(w)(x, y)$

(iv) $[\![\text{kissed}]\!]^g([\![\text{Mary}]\!]^g)([\![\text{John}]\!]^g = \lambda w.kissed(w)(John, Mary)$

b. (i) $[\![\text{John}_F]\!]^f = D_e$

(ii) $[\![\text{Mary}]\!]^f = \{[\![\text{Mary}]\!]^g\}$

(iii) $[\![\text{kissed}]\!]^f = \{[\![\text{kissed}]\!]^g\}$

(iv) $[\![\text{kissed}]\!]^f([\![\text{Mary}]\!]^f) = \{[\![\text{kissed}]\!]^g([\![\text{Mary}]\!]^g)\}$

(v) $[\![\text{VP}]\!]^f([\![\text{John}_F]\!]^f) = \{\lambda x.\lambda w.kissed(w)(x, Mary)\}([\![\text{John}_F]\!]^f)$

$= \{\lambda w.kissed(w)(x, Mary) \mid x \in D_e\}$

In other words, the interpretive system assigns two values to each constituent, as stated in (6) following (Rooth 1985:14). If there is no F-mark on a given constituent, its focus value is identical to the singleton containing just the ordinary value.

[3] In the following I will mostly not use the set notation in this special case and pretend that the focus value is literally identical to the focus value. But the reader should keep in mind that this is just an abbreviation.

[4] Throughout subscript F indicates F-marks.

(6) *Semantic values*

a. (i) $[\![\mathrm{A}_{F,\tau}]\!]^g = A$

(ii) $[\![\mathrm{A}_{F,\tau}]\!]^f = D_\tau$

b. (i) $[\![\mathrm{A}_\tau]\!]^g = A$

(ii) $[\![\mathrm{A}_\tau]\!]^f = \{[\![\mathrm{A}_\tau]\!]^g\}$

Following Hamblin (1973) and Rooth (1985) the rule of functional application can be defined as in (7) when dealing with sets, as is necessary in the case of focus values. I assume that the rule in (7) is only necessary for the computation of focus values. In other words, ordinary values do not correspond to sets.

(7) *Functional application*

Given branching node A with daughters B of type $\langle\sigma\tau\rangle$ and C of type $\langle\sigma\rangle$, $[\![\mathrm{A}]\!]^f = \{f(x) \in D_\tau : f \in [\![\mathrm{B}]\!]^f \text{ and } x \in [\![\mathrm{C}]\!]^f\}$.

The rule of predicate abstraction is a little bit more complicate to define. A definition close to the standard predicate abstraction rule cannot be adopted for the following reason: Imagine a constituent denoting a proposition with a numerical index adjoined to it. Under the normal formulation of predicate abstraction one would obtain an object of type $\langle e\langle st, t\rangle\rangle$ as the focus value for the constituent made up of the index and the proposition-denoting constituent, i.e., a function from individuals into sets of propositions. This object, however, cannot undergo further functional application when combined with a set of quantifiers, say. What is needed for this purpose is an object of type $\langle\langle e, st\rangle t\rangle$, i.e., a set of properties. For simplicity I will adopt the predicate abstraction rule formulated in (8). What it does is to form a set of properties by abstracting over the ordinary value of the constituent the index is adjoined to under the modified assignment that is just like the normal assignment except that it replaces each instance of the numerical index with x and moreover replaces each F-mark with y. The latter variable is existentially quantified over. This in effect means that F-marks are treated as indices by the rule

of predicate abstraction (and should accordingly bear numerical indices, cf. Kratzer (1991)).[5]

(8) *Predicate abstraction*

If A is a branching node with daughters B of type $\langle\tau\rangle$ and a numerical index i, $[\![\text{A}]\!]^f = \{f \in D_{\langle e,\tau\rangle} : \exists y[f = \lambda x.[\![\text{B}]\!]^{g[x/i],[y/F]}]\}$

Let us now consider how Rooth's 1992b system deals with focus. For contrastive focus and question-answer pairs he assumes the following: A constituent A having an F-mark must have a constituent B dominating it and there must be an antecedent constituent B' such that the ordinary semantic value of B', $[\![\text{B'}]\!]^g$ is a member/subset of the focus value of B, $[\![\text{B}]\!]^f$. Rooth formalizes this by assuming an operator $\sim$. This operator is attached to B and coindexed with an antecedent constituent. The $\sim$-operator takes two arguments, namely the denotation of the contextual restriction C and the ordinary value of the constituent it is attached to. $g(C)$ denotes a set of contextual alternatives. These alternatives are provided by the antecedent coindexed with the operator – that is, $g(C)$ is set to the ordinary value of the antecedent constituent A. The operator adds the presupposition that $g(C)$ is a subset or a member of the focus value of the sister constituent of $\sim$. In more concrete terms, the question-answer pair in (9) has the LFs in (10).

(9) A: Who married John?

B: RITA married John

[5]The problem with this formulation is that it makes use of the ordinary value rather than the focus value of the constituent B. In other words, it mixes Rooth's 1985 system, where F-marks introduce alternatives directly, and Kratzer's 1991 approach, where F-marks are indices subject to a special assignment function. In the latter approach alternatives only come about by quantification over such assignments. In order to get rid of this non-elegant formulation maintaining Rooth's system, one would have to assume that variable assignments are inside the alternatives considered – that is, each expression denotes a function from assignments into some type. This is already assumed by Rooth (1985). Also cf. Novel and Romero (to appear) for an approach along these lines. For our present purposes the simplified rule should, however, be harmless. As far as I can see, the same sets of objects are delivered by the two rules and switching back and forth between the two systems (as long as this switching is regulated by the rules in the text) does not seem that problematic for expository reasons. Another formulation of the predicate abstraction rule for alternative semantics is proposed in Kratzer and Shimoyama (2002). It would not run into one of the problems considered in the text below. This is, however, due to the reason that it overgenerates alternatives. It has already been observed in a different empirical domain by Shan (2004) that this is the case.

(10) a. $[_{\text{CP}}$ who married John$]_1$

b. $\sim_1$ C $[_{\text{IP}}$ Rita$_F$ married John]

The $\sim$-operator is defined as in (11), where we focus on the case where $g(C)$ is a subset of the respective focus value, because this is the more general case. Note that $\sim$ resets the focus value of the constituent dominating it to the ordinary value of its sister. This way no unused focus values accumulate.

(11) a. $[\![\sim]\!]^g(g(C)_{\langle\tau,t\rangle})([\![\phi]\!]^g{}_\tau) = [\![\phi]\!]^g$

if $g(C) \subseteq [\![\phi]\!]^f$, otherwise undefined

b. $[\![\sim]\!]^f(g(C)_{\langle\tau,t\rangle})([\![\phi]\!]^f{}_{\langle\tau,t\rangle}) = \{[\![\phi]\!]^g\}$

Following Hamblin (1973) and Karttunen (1977) the meaning of a question is the set of propositions that qualify as answers, i.e., the denotation of the question in 2 corresponds to the set of propositions {that Mary married John, that Sue married John, that Rita married John,...}.[6] The denotation of the question in (10a) is thus as in (12a). $\sim$ requires that the meaning of the question is a subset of the focus value of IP in (10b), given in (12b). Under the present assumptions, the two values are in fact equivalent. (12b) is a short form for the set in (13), which makes this fact obvious. So the requirement of $\sim$ is satisfied and the focus is licensed.

(12) a. $[\![(10a)]\!]^g = \{p : \exists x[p = \lambda w.marry(w)(x, John)]\}$

b. $[\![\text{IP}]\!]^f = \{\lambda w.marry(w)(x, John) \mid x \in D_e\}$

(13) $\{p : \exists x[p = \lambda w.marry(w)(x, John)]\}$

Before turning to our initial examples, consider cases with focus on bound pronouns that are actually unproblematic. In particular, consider the question-answer pair in (14). Here we notice that there is focus on the reflexive bound pronoun. Assume that the corresponding LFs are as

[6] In Karttunen's 1977 theory a question denotes the set of true answers. I will not assume that the set denoted by a question has only its true answers in it. I.e., I will follow Hamblin (1973) more closely. See Beck and Rullmann (1999) for an argument supporting this view.

given in (15).

(14) a. Who did every boy see?

b. Every boy saw himSELF

(15) a. $[_{CP}$ who 1[did every boy see t_1]$]_3$

b. $\sim_3$ C $[_{IP}$ every boy 4[t_4 saw [self$_F$ 4]]]

The ordinary value for the question is given in (16a), and the focus value for the answer in (16b). Here it is assumed that the reflexivization process is brought about by the identity function applying to the bound variable. The focus value therefore quantifies over functions of type $\langle e, e\rangle$.[7] Again, the ordinary value of the antecedent is a subset of the relevant focus value. It is not necessary to assume that the wh-expression also introduces a functional variable that is existentially quantified over, although nothing would change if it did.

(16) a. $[\![(15a)]\!]^g = \{p : \exists x[p = \lambda w.\forall y[boy(w)(y) \rightarrow see(w)(y, x)]]\}$

b. $[\![\text{IP}]\!]^f = \{\lambda w.\forall x[boy(w)(x) \rightarrow see(w)(x, f(x))] \mid f \in D_{\langle e,e\rangle}\}$

Consider now our initial example with the stressed bound pronoun, repeated in (17).

(17) Every student cut his (own) arm, and every TEACHER cut HIS arm

The problem for a theory making use of focus values can be characterized as follows: Assume the LFs for the first and the second conjunct are as in (18), respectively. I.e., the first sentence functions as antecedent for the $\sim$-operator attached to the second sentence.

(18) a. $[_{IP}$ every student 1[t_1 cut 1's arm]$]_2$

b. $\sim_2$ C $[_{IP}$ every teacher$_F$ 1[t_1 cut 1_F's arm]]

[7] Cf. Dimitriadis (2001) and Jacobson (2000) where an approach along these lines is extended to all cases of focused bound pronouns. I.e., in these approaches bound pronouns are always functions of type $\langle e, e\rangle$. In section 2.5.2, I give an argument against Sauerland's 2000 approach that extends to Jacobson's.

Now let us compute the focus value for the constituent ~ attaches to. In particular, we have to consider what the alternatives for the bound pronoun are. A pronoun is of type e. This means that its alternatives are constituted by the domain of individuals (19a). When combining this with the verb, we get the set of properties {*λx.x cut John's arm, λx.x cut Mary's arm, λx.x cut the teacher's arm,...*}, (19d).[8] The antecedent QNP has as focus value the set of the form {*λP.every boy P, λP.every girl P, λP. every teacher P,...*}, (19e). Applying each member of this set to each member of the focus value of the VP returns (19f). This means we get the set of propositions spelled out in (20).

(19) a. $[\![1_F]\!]^f = D_e$

b. $[\![[1_F\text{'s arm}]]\!]^f = \{x'\,s\ arm \mid x \in D_e\}$

c. $[\![\text{cut}]\!]^f = \{\lambda y.\lambda x.\lambda w.cut(w)(x,y)\}$

d. $[\![1\ [\text{t}_1\ \text{cut}\ 1_F\text{'s arm}]]\!]^f = \{\lambda x.\lambda w.cut(w)(x, y'\,s\ arm) \mid y \in D_e\}$

e. $[\![[\text{every teacher}_F]]\!]^f = \{\lambda Q.\lambda w.\forall x[P(w)(x) \rightarrow Q(w)(x) \mid P \in D_{\langle e,st\rangle}\}$

f. $[\![\text{IP}]\!]^f = \{\lambda w.\forall x[P(w)(x) \rightarrow cut(w)(x, y'\,s\ arm)] \mid y \in D_e, P \in D_{\langle e,st\rangle}\}$

(20)
$$\left\{\begin{array}{c}\text{that every boy cut John's arm}\\ \text{that every teacher cut the president's arm}\\ \text{that every teacher cut John's arm}\\ \text{that every girl cut John's arm}\\ \text{that every girl cut Mary's arm}\\ \ldots\end{array}\right\}$$

The problem with the focus value in (20) is that the ordinary semantic value of the antecedent (21) is not a member/subset of it. Thus the presupposition of ~ that $g(C)$ be a subset of the focus value in (20) is not satisfied and the focus on the pronoun – and in fact also the one on the antecedent restrictor – should not be licensed. In other words, (17) is predicted to be

[8] Recall the predicate abstraction rule (45) from above. The set of properties is determined as follows: $\{f_{\langle e,st\rangle} : \exists y[f = \lambda x.[\![[\text{t}_1\ \text{cut}\ 1_F\text{'s arm}]]\!]^{g[x/1],[y/F]}]\}$. Every instance of the index i is replaced by the variable x. The lower i, however, has an indexed F-mark attached to it. Therefore it is replaced by the variable y, which is existentially quantified over to get a set of alternatives back. This is equivalent to $\{f_{\langle e,st\rangle} : \exists y[f = \lambda x.\lambda w.cut(w)(x, y'\,s\ arm)]\}$.

ungrammatical.

(21) $[\![(18a)]\!]^g = \lambda w.\forall x[student(w)(x) \rightarrow cut(w)(x, x's\ arm)(w)]$

The reason for this is clear. The bound pronoun has as its alternatives the set of individuals, i.e., the domain of quantification. But the pronoun itself lacks a referent. I.e., it itself is not a member of that domain. This means that the problem posed by focus on bound pronouns is that the binding relation is destroyed in the alternatives. In other words, the binding relation cannot be recovered in the set of alternatives. What we see is the following: In Rooth's theory we run into the problem that the ordinary semantic value of the sentence is not a member of the focus value of the same sentence – that is, of its alternatives. This is because the binding relation of the original sentence is not carried over into the alternatives. In section 2.3, I will discuss how this puzzle can be handled.

2.2.2 Two worries

Before turning to the issue of optionality of focus on bound pronouns, I have to address two worries that the reader might have at this stage.

2.2.2.1 Syntactic agreement fails

When first exposed to the problematic data, one might suppose that the focus on the bound pronoun is actually inherited from the antecedent via some syntactic agreement mechanism, i.e., from the quantifier binding the pronoun. In particular, such a hypothesis might be reinforced by the observation that the antecedent must always bear stress, as the unacceptability of (22) shows. As we have seen, focus on the pronoun, on the other hand, appears to be optional. The initial data, repeated in (23), show this. Given the fact that focus on the antecedent seems to be absolutely required, whereas the one on the bound pronoun is less stable, one might reason that the latter is only a reflex of the former. In other words, the focus on the bound pronoun is not interpreted, but only the one on the antecedent quantifier is. I will not go into detail how such a

theory would look like, for the reasons noted immediately below.[9] But before discussing these reasons, it must be noted that the difference between (22) and (23) in acceptability should be accounted for by our proposal. We will come back to this issue.

(22) *Every student cut his (own) arm, and every teacher cut HIS arm

(23) a. Every student cut his (own) arm, and every TEACHER cut HIS arm

b. Every student cut his (own) arm, and every TEACHER cut his arm

The prediction of an account relying on syntactic agreement is that whenever part of the antecedent of a bound pronoun is stressed, the pronoun should be possible to be stressed, too. Jacobson (2000) argues that this is incorrect, as the necessary assumptions would predict that stress on the bound pronoun should be possible in examples like (24b), given that part of the antecedent can be contrastively focused. This is, however, not the case. The reason for this, she argues, seems to be that there is no contrasting antecedent for the pronoun itself. The bound pronoun is obligatorily destressed, as only (24a) is an option.[10]

(24) a. Every third grade boy ran together with John, and every FOURTH grade boy DANCED with his MOTHER

b. #Every third grade boy ran together with John, and every FOURTH grade boy DANCED with HIS MOTHER/HIS mother

[9]It has been claimed in the literature that features like number are not interpreted on bound pronouns. Rather these features are interpreted on the antecedent, whereas no features are present on the pronoun at LF. There are different implementations of this general idea. I refer the reader to Heim (2008), Kratzer (1998a), von Stechow (2003), a.o. But see Rullmann (2004) for arguments that some of these features must be interpreted on the bound pronoun.

[10]The actual example used by Jacobson is the one in (i). Gennaro Chierchia (p.c.) notes that it suffers from the fact that it could be construed as a right-node-raising construction, which would defeat its purpose. This is why the example in the text contains an internal argument in the antecedent sentence, as well.

(i) Every third grade boy ran, and every FOURTH grade boy DANCED with his MOTHER/*HIS mother/*HIS MOTHER.
(Jacobson 2000:(17))

Confronted with the construction in (24b), a defender of the syntactic account might propose that it is unacceptable, because it does not fit the structural description where the proposed syntactic rule could apply.[11] In particular, one might be tempted to claim that the rule can only apply given the structure in (25). R is the restrictor of the quantifier Q, and the restrictor as a whole must be focused in order for the rule to apply. One could then assume that the rule is prohibited to apply in the structure in (26). It differs from (25) by having not the whole restrictor focused but only a constituent embedded in it. In other words, under this view one would claim that (24b) is impossible, because *fourth*, an embedded element, is stressed. But this would mean that (24b) would correspond to the prohibited (26). (23a), on the other hand, is fine, because it instantiates the good (25).

(25) $[[\ \mathrm{Q}\ [_{\mathrm{R}} \ldots \mathrm{X} \ldots]_{F}]\ \mathrm{i}[\ldots \mathrm{i}_{F} \ldots]]$

(26) $*[[\ \mathrm{Q}\ [_{\mathrm{R}} \ldots \mathrm{X}_{F} \ldots]]\ \mathrm{i}[\ldots \mathrm{i}_{F} \ldots]]$

However, it is simply not true that a bound pronoun cannot be contrastively focused under the structural description in (26). As (27) shows even when the focus on the restrictor of the quantifier is embedded in a relative clause, focus on the bound pronoun is optionally available, as long as there is in antecedent with which the bound pronoun can contrast.

(27) a. Every boy who is in elementary school loves his mother, while every boy who is in HIGH school, loves HIS mother

b. Every boy who is in elementary school loves his mother, while every boy who is in HIGH school, loves his mother, too

To further counter the syntactic argument, we note that there are clear cases of focused bound pronouns whose antecedents are not stressed at all. In cases where there is no material that the antecedent quantifier could contrast with, it is not prohibited to stress a bound pronoun. Consider (28). Here the bound pronoun contrasts with *advisor*, but there is no contrasting material

[11] I thank Gennaro Chierchia (p.c.) for bringing up this point.

for the antecedent quantifier. If the stress on the bound pronoun were just epiphenomenal to an agreement relation with the restrictor of an antecedent quantifier, (28) should be unacceptable. What (28) shows is that there are cases where bound pronouns are contrastively stressed without parallel stress on the antecedent quantifier. The problems discussed in the preceding subsection would arise in such cases independently, even if one could make an argument that focus on bound pronouns is sometimes due to an agreement relation, which already seems unlikely because of (26).[12]

(28) Every student likes only HIS paper, and NOT JOHN's paper

(28), moreover, shows that focus operators like *only* can associate with focus on bound pronouns. Just for this reason some way is needed to deal with focus on bound pronouns. So we conclude that focus on bound pronouns is not due to an agreement process with a focused antecedent constituent. It follows then that focus on bound pronouns should be accounted for by a semantic theory of focus licensing such as the one discussed above.

2.2.2.2 The binders must be taken into account

Now that we have convinced ourselves that a syntactic agreement mechanism is not enough to account for focus on bound pronouns, we have to address a different route that one might try to avoid the problem noted in subsection 2.2.1. One might think that the binder need in fact not be taken into account when checking whether the focus on the bound pronoun is licensed.

[12] Sauerland (2000) cites (i) as an additional point against the agreement analysis. He claims that if focus on the pronoun were merely inherited from the antecedent via some agreement mechanism, it should be possible to read (i) under the paraphrase *'Each boy called his own mother before every teacher called the boy's mother'*. I.e., it should be felicitous to take *every boy* to be the antecedent for the stressed pronoun. This is, however, not the case. Again, a defender of the syntactic hypothesis might be able to claim that (i) is unacceptable for some independent reason. In particular, one might argue that what blocks the paraphrase given is some version of the minimality principle – that is, the focus on the bound pronoun is not inherited from the closest possible syntactic binder, and this, one could argue, is not allowed. In other words, inheritance of focus would have to be from the closest available binder. At any rate, (i) might be another argument against the agreement approach.

(i) *Every BOY called his mother before every TEAcher called HIS mother.
(Sauerland 2000:170)

In particular, all that might be required for focus on a bound pronoun to be licensed is that the value assigned to the variable contrasts with the value assigned to the antecedent variable, and moreover the value of the antecedent variable must be a member of the focus value of the focused variable. To see how this would work, assume that our example (23a) has the LFs in (29) with a ∼-operator attached to the DP [2_F's arm]. Moreover assume that the assignment function g delivers differing values for the variables 1 and 2, i.e., $g(1) \neq g(2)$. In that case the focus value of the relevant DP would be as in (30). The value of the antecedent DP is member of that value. Moreover, by assumption the ordinary values of the DPs differ. Therefore focus would be licensed under the assumption that the assignments to the variables involved differ.

(29) a. every student 1[t_1 cut 1's arm]

b. every teacher$_F$ 2[t_2 cut [∼ C [2_F's arm]]]

(30) $[\![[2_F\text{'s arm}]]\!]^f = \{x'\,s\ arm \mid x \in D_e\}$

Sauerland (1998) indeed proposes such an account. A number of arguments have been given in the literature that contradict these assumptions. First, Jacobson (2000) already notes that data given in Sauerland (1998) and attributed to Irene Heim (p.c.) make the solution just sketched unlikely. In case the quantifier domains overlap as in the example in (31), contrastive focus on the bound pronoun is impossible. If all that were required is, however, that the assignments for the variables differ, this behavior would be unexpected. In particular, we would expect that we can choose an assignment that makes the pronouns contrast in the case of (31) as well. The clue seems to be that the bound pronouns in (31) do not really contrast given the fact that the domains of the quantifiers binding them do not fully contrast either. In other words, a focus on a bound pronoun is only licensed if it is still licensed when the binder of the pronoun is taken into account. The licensing cannot be completely local. This is the intuition that the present proposal will follow.

(31) *I expected every student to call his father, but only every YOUNG student called HIS father.

(Sauerland 1998:206)

Another case against the assignment-dependent approach has been noted by Sauerland (2000, 2008) himself. He notices that the adnominal use of *however* requires that the denotation of the subject in the antecedent and the one in the utterance sentence contrast, and that the denotations of the VPs involved do, as well. In particular, what seems to be required is that the value of the antecedent VP be a member of the focus value of the utterance VP. This means that focus evaluation should take place at the VP-level. But if this is so the VPs in (32), for instance, will not differ, because they are alphabetic variants. The use of *however* does not allow focus evaluation at a lower point than VP. In other words, even if the assignment function were to assign differing values to the variables, this would be of no help in the present case. Note moreover that the focus on the bound pronoun in (32) is obligatory, which is accounted for if *however* requires the VPs to contrast.

(32) *Discourse:* Every teacher believes that she'll win.

a. Every GIRL, however, believes that SHE'll win.

b. #Every GIRL, however, believes that she'll win.

(Sauerland 2000:171)

It therefore seems that the assignment-dependent approach is not feasible. The binders of the pronouns have to be taken into account when focus on the pronouns is evaluated. It should also be noted that the example in (32) is a further point against the syntactic hypothesis already dismissed in the previous subsection. Under this approach it would be hard to make sense of the obligatoriness of focus on the bound pronoun in case adnominal *however* is used. Since a defender of that idea would claim that focus on the pronoun is not interpreted at all, (32) would be a mystery, because it directly argues for a theory were the focus on the pronoun makes a semantic contribution. Otherwise the requirements of *however* would not be satisfied.

2.2.3 Optionality of focus

The observed optionality of focus that was meant to motivate a syntactic analysis presents another problem. As noted by Schwarzschild (1999), focus is usually not optional. Consider the discourses in (33) and (34), where A's utterance is followed by the utterances B/B' or C/C'

(33) A: John kissed Mary

B: Yes. And, BILL kissed SUE

B': #Yes. And, BILL kissed Sue

(34) A: John kissed Mary

C: Yes. And, BILL kissed Mary (too)

C': #Yes. And, BILL kissed MARY (too)

We observe that whenever constituents contrast, they must be stressed. Thus both the subject and the object are stressed in B. B' is an infelicitous continuation of A because *Sue* is not stressed, although it could be according to this view. On the other hand, C and C' show that *Mary* cannot be stressed because it does not contrast with the object in A. C' is a case of so-called overfocusing. The constituent *Mary* is stressed, although it is given – that is, it is given by virtue of there being an antecedent constituent in the context that entails it, namely *Mary* itself. To ban stress on constituents that are given, Schwarzschild argues for a condition that reduces focus on material that is given.[13] Although Schwarzschild does not use focus values in his system, a principle like AvoidF should also be incorporated into a theory with focus values. Otherwise Rooth's 1992b analysis would predict that C' is actually felicitous. For present purposes we could assume a formulation as in (35) (cf. Mayr (to appearb) for a different implementation), which is a straightforward implementation of Schwarzschild's principle. What this condition says is that if there are two structures with the same interpretation such that in both cases all the foci are licensed, the one with the fewer number of F-marks is preferred. The consequence is that (35) prefers C to C', as both are fine according to Rooth's system, but C has

[13]For a more detailed discussion of Schwarzschild's 1999 system see subsection 2.5.4.

less F-marks than C'. B', on the other hand, does not satisfy focus licensing, whereas B does. Therefore (35) does not negotiate between B and B'.

(35) *AvoidF for a semantics with focus values*
If both structures S_1 and S_2 satisfy focus licensing, $[\![S_1]\!]^g = [\![S_2]\!]^g$, and S_1 has more F-marks than S_2, S_2 is preferred to S_1.

Let us now return to our initial constructions repeated in (36). We observe that focus on the bound pronoun is optional in a sense to be made precise below.

(36) a. Every student cut his (own) arm, and every TEACHER cut HIS arm
b. Every student cut his (own) arm, and every TEACHER cut his arm

(36b) is moreover licensed by the analysis introduced in subsection 2.2.1. To see this consider the following LFs.

(37) a. $[_{\text{IP}}$ every student 1$[\text{t}_1$ cut 1's arm$]]_2$
b. $\sim_2$ C $[_{\text{IP}}$ every teacher$_F$ 1$[\text{t}_1$ cut 1's arm$]]$

The ordinary value for the sentence in (37a) is as in (38). I.e., $g(C)$ is equal to (38). The focus value for the IP in (37b), on the other hand, is as in (39). Here the requirement imposed by the $\sim$-operator is fulfilled, because $g(C)$ is indeed a subset or member of (39).

(38) $[\![(37a)]\!]^g = \lambda w.\forall x[\mathit{student}(w)(x) \rightarrow \mathit{cut}(w)(x, x's\ \mathit{arm})]$

(39) $[\![\text{IP}]\!]^f = \{\lambda w.\forall x[P(w)(x) \rightarrow \mathit{cut}(w)(x, x's\ \mathit{arm})] \mid P \in D_{\langle e,st\rangle}\}$

Although, (36a) is currently blocked from surfacing by our theory of focus licensing, the considerations about AvoidF together with the fact that (36b) is licensed has the consequence that (36a) should even be blocked if we could somehow motivate (36a) using Rooth's theory. This is simply so because (36b) has less foci than (36a). This means that not only must we reconsider

the assumptions that brought Rooth's theory about. Moreover, we must make sure that either AvoidF as currently formulated does not block (36a), once the theory of focus licensing and the LFs involved have been amended, or that AvoidF is somehow changed as well. Section 2.3 is an attempt to do the former.

Before going there, I will briefly introduce data that prove to be problematic for previous approaches to the problem at hand. We will come back to these analyses in subsection 2.5.1.

2.2.4 Why a functional analysis fails

Sauerland (2000, 2008) assumes that our problematic sentences have differing LFs.[14] The one with focus on the bound pronoun has the LFs in (40), whereas the one without has the LFs in (41). That is, Sauerland proposes that the bound pronoun must be an E-type pronoun corresponding to a definite description when it is focused. Notice that it is the property in the definite description that bears the F-mark.[15]

(40) a. [every student$_4$]$_9$ [1[t$_1$ cut [[the$_1$ student$_4$]'s arm]]]$_8$

b. $\sim_9$ C$_2$ [every teacher$_{5,F}$]] [$\sim_8$ C$_1$ 1[t$_1$ cut [[the$_1$ teacher$_{5,F}$]'s arm]]

(41) a. [every student 1[t$_1$ cut 1's arm]]$_2$

b. $\sim_2$ C [every teacher$_F$ 3[t$_3$ cut 3's arm]]

For reasons of space, I will keep the discussion informal. Assuming that the property embedded in the definite description makes the VPs partial functions, the denotations in (42) obtain for the VPs in (40). The first VP is only defined for students, whereas the latter is only defined for

[14] Also cf. Elbourne (2005), who follows Sauerland to a large extent. For how the problem below extends to Jacobson's 2000 analysis see subsection 2.5.1.

[15] In other words, the NP in the restrictor of the quantifier functions as the syntactic antecedent for the NP in the pronoun indicated by coindexation (cf. the discussion in Heim (1990) and (Chierchia 1990:158f.) especially). This could, for instance, be done by treating pronouns as cases of ellipsis (cf. Heim (1990), Elbourne (2005) a.o.). Sauerland (2008) himself argues against an ellipsis analysis, but this is immaterial to the present discussion. For simplicity, I will present the semantic content of the NP inside the pronoun syntactically.

teachers.[16]

(42) a. $\lambda x.\lambda w : \mathit{student}(w)(x).\mathit{cut}(w)(x, x'\mathit{s\ arm})$

b. $\lambda x.\lambda w : \mathit{teacher}(w)(x).\mathit{cut}(w)(x, x'\mathit{s\ arm})$

The focus value for the VP in (40b) is as in (43), where the property of being a teacher is replaced with its alternatives. (42a) is a member of that set. Moreover the partial functions in (42) contrast with each other. Therefore the focus on the pronoun is licensed. It is easy to see that the focus on the restrictor in the quantifier is also licensed.

(43) $[\![(42)]\!]^f = \{\lambda x.\lambda w : Q(w)(x).\mathit{cut}(w)(x, x'\mathit{s\ arm})] \mid Q \in D_{\langle e,st\rangle}\}$

It must be noted that under this analysis the focus on the bound pronoun cannot be dropped. If one were to do so, the focus value of the VP in (40b) would correspond to the singleton containing just (42b). In other words, (42a) would not be a member of the focus value, and thus the structure would not be licensed. The principle AvoidF striving to reduce F-marks cannot apply, as only the structure with F-mark is licensed to begin with. As already said, the construction without focus on the bound pronoun is licensed by LFs with plain variables (41). We have already seen how licensing proceeds in this case. Summarizing, Sauerland's account explains the presence of focus on bound pronouns and the perceived optionality.

There is a problem with this account, and it has to do with the possible co-occurrence of an F-mark on the bound pronoun and additive *too*:

(44) Every director discussed his film, and every PRODUCER discussed HIS film, too

Let us assume the anaphoric entry for *too* in (45) following (Heim 1992:189). That is, *too* associates with focus on X and requires that there is a contrasting alternative Y in the context such that when X is replaced by Y, the denotation of the outcome is true.

[16]The examples in (42) and other examples to come use Heim and Kratzer's 1998 notation for partial functions. $\lambda\xi : \phi(\xi).\psi(\xi)$ is a function that is only defined for objects of which ϕ is true.

(45) $[\![[_{\phi} \ldots X_F \ldots]\ too_i]\!]^g(w) = [\![[_{\phi} \ldots X_F \ldots]]\!]^g(w)$
if $[\![Y_i]\!]^g \in [\![X]\!]^f$, $[\![Y_i]\!]^g \neq [\![X]\!]^g$ and
$[\![[_{\phi} \ldots Y_i \ldots]]\!]^g(w) = 1$, otherwise undefined

The LFs for (44) would accordingly be as in (46). The problem with (46) is that when the restrictor *producer* is replaced by *director*, as the semantics of *too* would have it, the value of the resulting sentence is undefined. The reason is that the predicate denoted by the VP is only defined for producers, i.e., it is undefined for directors. Thus (44) should be ungrammatical.

(46) a. every director$_5$ 1[t$_1$ discussed [[the$_1$ director]'s film]]
b. every producer$_F$ 1[t$_1$ discussed [[the$_1$ producer$_F$]'s film]] too$_5$

The account cannot be saved by assuming that *too* associates with both foci so that both instances of *producer* are replaced by *director*. The reason for this is that *too* does not associate with two foci. If (47) is good at all, it marginally has the interpretation in (47b). Here *Bill* is contrastively stressed, whereas *too* associates with focus on *Sue*. The antecedent for *Sue* is contextually provided – that is, *Mary* functions as antecedent. But (47) cannot have the interpretation in (47a), because multiple association with focus is prohibited for *too*.

(47) John$_6$ kissed Mary$_8$, and BILL$_F$ kissed SUE$_F$, too$_{6,8}$
a. #'John kissed Mary, and Bill kissed Sue.'
b. ?'John kissed Mary, and Bill kissed Mary and in addition Sue.'

Satoshi Tomioka (p.c.) reminds me that the restriction of *too* being able to associate with only one focus has already been noted by Kaplan (1984):

(48) a. *Jo had fish and Mo had soup too.
b. Jo had fish and Mo had soup.
(Kaplan 1984:510)

Thus Sauerland's very attractive account making use of bound E-type pronouns makes the wrong predictions for certain cases. In the following section I will suggest an alternative analysis.[17]

2.3 The proposal

The constructions that we started our discussion with are repeated in (49). We want our theory of focus licensing to allow for the possibility of focusing bound pronouns.

(49) a. Every student cut his (own) arm, and every TEACHER cut HIS arm

b. Every student cut his (own) arm, and every TEACHER cut his arm

Moreover, we also want to be able to account for cases of association with focus on bound pronouns. Consider (50), also repeated from above.

(50) Every student only likes HIS paper, and NOT JOHN's paper

The section proceeds as follows: In subsection 2.3.1 I show that for (50), which has a ∼-operator inserted locally, – that is, in the scope of the quantifier – in order to interpret the focus on the bound pronoun, it is unproblematic to derive the correct alternatives under the usual assumptions. In the following subsections, I show how having a ∼-operator locally inserted can be extended to account for the cases in (49). The proposal consists of two assumptions: First, the notion of *salient* alternatives is introduced as a cover term for all alternatives that can function as contextual alternatives – that is, both the ones provided by actual linguistic objects as the ones derived in other ways. Regarding the latter possibility, it is argued that through a process of compositional reconstruction one can derive further salient alternatives than just the ones provided by actual linguistic objects. In subsection 2.3.4 a second assumption is introduced into the theory. There I claim that contrastiveness is a necessary notion for contrastive focus, in

[17] It must, however, be added that bound E-type pronouns might be needed for other cases. The crucial point made in this subsection is that the theory of focus licensing should not rely on E-type pronouns when having to deal with focus on bound pronouns.

order to account for the data from the preceding section showing that focus on bound pronouns is impossible if the domains of the quantifiers overlap. Contrastiveness is made a presupposition of the ∼-operator. These assumptions will allows us to tackle the issue of optionality in subsection 2.3.5.

2.3.1 Focus operators in the scope of quantifiers

In subsection 2.2.1 it was seen that the focus alternatives of a VP denoting a bound variable configuration where the bound pronoun is focused do not include the ordinary value of that VP as a member. This was shown to be problematic. In the present subsection I suggest that this is the correct way of thinking about such focus values nonetheless. I first show that the alternatives give the correct result for cases of focused bound pronouns associating with *only* via an intermediate ∼-operator. As will be seen, no deviation from Rooth's system is necessary for cases of association with focus on bound pronouns. I then suggest to view contrastive focus on bound pronouns in a parallel way – i.e., the evaluating ∼-operator must also be in the scope of the quantifier in such situations.

Following Rooth (1992b) I assume that focus is interpreted by the ∼-operator. Moreover, I follow Rooth (1985) and in particular (Beck 2006:15) in the assumption that the ∼-operator resets the focus value of the constituent it is immediately contained in to the ordinary value of its sister constituent, as stated in (51), repeated from (11) above. Moreover, it adds the presupposition that the contextually relevant set of alternatives $g(C)$ be a subset of the focus value of the syntactic sister of the operator.

(51) a. $[\![\sim]\!]^g(g(C)_{\langle\tau,t\rangle})([\![\phi]\!]^g{}_\tau) = [\![\phi]\!]^g$

if $g(C) \subseteq [\![\phi]\!]^f$, otherwise undefined

b. $[\![\sim]\!]^f(g(C)_{\langle\tau,t\rangle})([\![\phi]\!]^f{}_{\langle\tau,t\rangle}) = \{[\![\phi]\!]^g\}$

Let me now illustrate the idea that what we deemed to be a problematic set of alternatives is actually fine for association with focus on bound pronouns. I will do so by employing an overt

focus operator in the scope of a quantifier such as in (52).

(52) Every director only discussed HIS film. (No director discussed anyone else's film)

Following Horn (1969) (also cf. von Fintel (1999)) let us assume that the semantics of *only* has both an assertive and a presuppositional component to it. For (52) it presupposes the truth of the prejacent – that is, it presupposes that every director discussed his film – and it asserts that no director discussed a film other than his own. Following Rooth (1992b) (also cf. von Fintel (1994)) we furthermore assume that *only* takes two arguments: its syntactic sister and a contextually determined set of alternatives C. The denotation of C, $g(C)$, is provided indirectly via the use of the $\sim$-operator. Recall that the $\sim$-operator is the only operator that can interpret focus. In other words, in the scope of *only* there is a $\sim$-operator adding the condition on the set of alternatives used, as given in (51). This set is then used as the first argument by *only*.

(53) $[\![\text{only}]\!]^g(g(C)_{\langle\langle st\rangle t\rangle})(p_{\langle st\rangle})(w) = 1$ iff $\forall q \in g(C)[q(w) = 1 \rightarrow p \subseteq q]$
if $p(w) = 1$, otherwise undefined

It follows that the LF for (52) must be as in (54). Both *only* and the $\sim$-operator must be part of the structure. But note that I am assuming that the $\sim$-operator together with the contextual restriction C is attached to the constituent denoting a predicate created by abstraction over the trace of the quantifier and the bound pronoun, because it makes the exposition simpler.[18]

(54) every director $[_{\text{VP}_3}$ only C $[_{\text{VP}_2} \sim$ C $[_{\text{VP}_1}$ 1[t_1 discussed 1_F's film]]]

But this has the consequence that we also need to assume a predicate-level *only* alongside the propositional one given in (53). Cf. (Rooth 1985:chapter 3) for a cross-categorial semantics for

[18]The question how the LF in (54) is derived must be addressed. If we adopt Heim and Kratzer's 1998 convention where a QRed DP transfers its index onto its sister node, (54) would not be an option because the index that will be interpreted as a λ-abstractor is not on the sister node of the quantifier. Several modifications of this convention come to mind. For instance, one could relax the convention and assume that the index of a QRed DP must be attached to a node that dominates the trace and denotes a proposition. This is fulfilled by (54). I leave the discussion at these inconclusive remarks.

only. Assume the following entry:

(55) $[\![\text{only}]\!]^g(C_{\langle\langle e,st\rangle t\rangle})(P_{\langle e,st\rangle}) = \lambda x.\lambda w.\forall Q \in g(C)[Q(w)(x) = 1 \rightarrow P(x) \subseteq Q(x)]$
if $P(w)(x) = 1$, otherwise undefined

The compositional interpretation of (54) gives the following result: First we compute both the ordinary value (56a) and the focus value (56b) of the sister of the ∼-operator. The ordinary value and the focus value of VP_2 are the same (56c), namely: They are identical to the ordinary value of VP_1. VP_3 adds the semantic contribution of *only* (56d). Then we apply the ordinary value of the quantifier to the ordinary value of VP_3 (56e). Remember that $[\![VP_2]\!]^g$, and by extension the whole sentence, is only defined if $g(C)$ is a subset of the focus value of the sister of VP_2 (57a). This is the presupposition of the ∼-operator.[19] In addition there is the definedness condition provided by *only*, argued for by Horn (1969). It requires that every director discussed his own film (57b).

(56) *Assertive component of (54)*

a. $[\![VP_1]\!]^g = \lambda x.\lambda w.discuss(w)(x, x's\ film)$

b. $[\![VP_1]\!]^f = \{\lambda x.\lambda w.discuss(w)(x, y's\ film) \mid y \in D_e\}$

c. $[\![VP_2]\!]^g = [\![VP_2]\!]^f = [\![VP_1]\!]^g$

d. $[\![VP_3]\!]^g = \lambda x.\lambda w.\forall P \in g(C)[P(w)(x) \rightarrow \lambda w'.discuss(w')(x, x's\ film) \subseteq P(x)]$

e. $[\![IP]\!]^g(w) = 1$ iff $\forall x[director(w)(x) \rightarrow \forall P \in g(C)[P(w)(x) \rightarrow$
$\lambda w'.discuss(w')(x, x's\ film) \subseteq P(x)]$

[19] Actually, the presupposition in (57a) should read as in (i). Since the presupposition trigger is embedded in the scope of a quantifier, it will project in a universal fashion (Heim 1983). But as the quantifier does not bind any variable in its scope, there is no danger in simplifying the presupposition as in (57a).

(i) $\forall x[director(w)(x) \rightarrow g(C) \subseteq \{\lambda z.\lambda w.discuss(w)(z, y's\ film) \mid y \in D_e\}]$

(57) *Presuppositional component of (54)*

a. $g(C) \subseteq \{\lambda x.\lambda w.discuss(w)(x, y's\ film) \mid y \in D_e\}$

b. $\forall x[director(w)(x) \rightarrow discuss(w)(x, x's\ film)]$

What do the presuppositions in (57) require when taken together? (57a) requires that the alternative set $g(C)$ is a subset of the set of predicates having the form in (58)

(58) $$\left\{ \begin{array}{c} \lambda x.\lambda w.discuss(w)(x, a's\ film) \\ \lambda x.\lambda w.discuss(w)(x, b's\ film) \\ \lambda x.\lambda w.discuss(w)(x, c's\ film) \\ \ldots \end{array} \right\}$$

Notice that the set alternatives relevant for the presupposition includes only alternatives with free pronouns dependent on the assignment function. The assertive component in (56e) says that any predicate in (58) with $\lambda P.\lambda w.\forall x[director(w)(x) \rightarrow P(w)(x)]$ applied to it, leads to truth in w only if it is entailed by the proposition resulting from applying $\lambda P.\lambda w.\forall x[director(w)(x) \rightarrow P(w)(x)]$ to the predicate $\lambda x.\lambda w.discuss(w)(x, x's\ film)$. (57b), on the other hand, requires that every director discussed his own film. Assume a is a director. Then the semantics just explained has the following consequence: a discussed a's film, and moreover any predicate in (58) which applies to a truly must be entailed by a having discussed his own film. Only the first alternative in (58) thus can yield a proposition that is true in w. I.e., this is the correct result: every director discussed his own film and only his own film.

Thus we arrive at the correct meaning for our sentence in (52) without actually having bound-variable configurations in the set of alternatives. I now want to suggest that this approach can be extended to the cases of contrastive focus on bound pronouns, which we started our discussion with. In particular, I suggest that also in these cases the $\sim$-operator is embedded in the scope of the quantifier. It will be seen presently that this assumption alone does not suffice, however, to explain why focus on bound pronouns is possible. Let us first turn to some slight refinements of Rooth's theory. I introduce the following two conditions on the nature of

∼-operators:

(59) *Conditions on* ∼

a. Each sentence S has ∼ attached to it and must contain at least one ∼.

b. ∼ cannot attach to a focused constituent directly.

So, (59a) requires that each sentence has the ∼-operator appended at the top node. An immediate consequence of this is that almost all if not even all sentences must have a focus somewhere. Other than that, insertion of ∼ is free. That is, further ∼-operators are optional. Another consequence of this condition is that focus *must* be checked. Furthermore (59b) says, following Rooth (1992b), that the operator cannot be immediately attached to a focused constituent. The latter condition is to make sure that the presupposition introduced by ∼ is not too weak. If it were directly adjoined to a focused constituent, the requirement on the context would be very weak. In particular, all that would be required is that there is some alternative to the interpretation of the focused constituent somewhere in the context. Returning to our crucial example (49a), repeated in (60), these conditions allow for at least the following representations of the focus sentence. (61b) is the structure that was used to exemplify the problem in the preceding section.

(60) Every director discussed his film, and every ACTOR discussed HIS film

(61) a. $\sim C_2$ [$_{IP}$ every actor$_F$ [$\sim C_1$ [$_{VP}$ 1[t_1 discussed 1_F's film]]]]

b. $\sim C_2$ [$_{IP}$ every actor$_F$ 1[t_1 discussed 1_F's film]]

In the following, I will argue that (61a) corresponds to the LF that gives rise to focus on the bound pronoun, whereas (61b) will still suffer from the by now familiar problem. Without going into discussion of the semantics of (61a) at this stage, it is clear, however, that adopting this structure is not enough. As said above, AvoidF modified to be usable in a theory with focus values along the lines of (35) would prefer the version without F-mark on the pronoun.

2.3.2 The first step in the proposal: Salient vs. formal alternatives

Rooth (1992b) discusses the example in (62). We notice that contrastive focus is licensed on the pronouns in the second sentence. Rooth assumes that the first sentence serves as antecedent for the second sentence with respect to focus licensing. Although the ordinary value the antecedent sentence is not a member of the focus value of the second sentence, the contextually entailed proposition *that he insulted her* is a member of that focus value. That is, entailment between the linguistic antecedent and the proposition serving as alternative holds if the context makes it clear that calling someone a Republican is an insult. Rooth thus assumes that it is not only actual linguistic objects that can function as antecedents for focus licensing.

(62) He_1 called her_2 a Republican, and then $\text{she}_{2,F}$ insulted $\text{him}_{1,F}$
(Rooth 1992b:81 fn.4)

The first part of the present proposal is to still widen the application of contextual focus licensing. Remember that in Rooth's theory the ordinary value of the constituent that ~ is coindexed with serves as the contextually relevant set of alternatives. Even for cases like (62), one can assume that the first sentence serves as intermediate antecedent somehow. For the present problematic cases this will not be enough, though. The problem in a nutshell is that the denotation of the antecedent VP – denoting a binding relation – is not a member of the focus value in question. Moreover, it itself does not entail properties that are members of the focus value. I suggest that Rooth's requirement of focus licensing should be somewhat loosened. In particular, I follow Rooth in keeping the coindexation requirement. In other words, contextual alternatives are always tied to a linguistic antecedent. But from such a linguistic antecedent further alternatives can be derived under certain conditions. In the following a distinction is drawn between *formal* and *salient* alternatives. The former are constituted by the set of alternatives provided by the focus value of the sister of the ~-operator. We can say the following:

(63) *Activation of formal alternatives*
Given [~ C [$_\phi$ ...]], ~ activates formal alternatives of the form of the focus value of its

sister ϕ, $[\![\phi]\!]^f$.

Once formal alternatives have been activated, the context must provide actual alternatives that fit the description of the formal ones, so that the presupposition of the ∼-operator can be satisfied. In other words, there must be alternatives salient in the discourse that satisfy the presupposition. These salient alternatives are, however, further restricted by the actual linguistic objects present. In particular, they are constrained by coindexation of ∼ with an antecedent constituent. Let us define salient alternatives as in (64).

(64) *Salient alternatives*

An alternative is salient if it corresponds to the ordinary value of a linguistic object A in the context, $[\![A]\!]^g$, or it can be inferred from $[\![A]\!]^g$, or it can be compositionally reconstructed using $[\![A]\!]^g$ and other information provided by the context.

The first possibility in (64) conforms to the standard case, where the ordinary value of a given linguistic object in the discourse matches the activated formal ones. The second situation corresponds to what is needed to rule in cases like (62) above. This move increases the number of potential alternatives. Further support that this is not an unwelcome result is provided by the discourse in (65). Note that it is possible to focus *Bill*. If the ∼-operator were coindexed with the antecedent sentence, focus on the subject would be unexpected. The meaning of utterance A is not a member of the focus value of the embedded clause in utterance B. If, on the other hand, A's utterance makes the proposition that John likes Sue salient, the focus on *Bill* is not surprising. It is worth noting that Schwarzschild's 1999 theory makes similar predictions, as it also allows for antecedents that are not actual linguistic objects. We will come back to a more detailed discussion of such questions in subsection 2.4.3.

(65) A: John kissed Sue

B: I thought that BILL likes Sue

B': #I thought that Bill likes Sue

Notice, moreover, that focus on *Bill* cannot be dropped, which is why B' is infelicitous in the given discourse. This suggests that salient alternatives must be used. That is, if the context makes alternatives available that fit the description of the formal alternatives activated by ∼, they must be used, and cannot be left out of $g(C)$.[20]

(66) *Salient alternatives must be used*

Given [∼ C [$_\phi$ . . .]], the set of salient alternatives provided by the context corresponding to the formal alternatives activated by ∼ must be used.

I suggest that we incorporate this last requirement directly into the entry of the ∼-operator, thereby modifying the presupposition that the ∼-operator adds. In other words, the presupposition of the operator is modified in the following way: In addition to the requirement that the contextual alternatives $g(C)$ must be a subset of the focus value, it is required that each salient alternative A_S that matches the chosen focus value must be a member of $g(C)$. This is only a slight modification of Rooth's 1992b original definition of the operator (A_S stands for salient alternative):

(67) a. $[\![\sim]\!]^g(g(C)_{\langle\tau,t\rangle})([\![\phi]\!]^g{}_\tau) = [\![\phi]\!]^g$

if $g(C) \subseteq [\![\phi]\!]^f$, and

$\forall A_S [A_S \in [\![\phi]\!]^f \rightarrow A_S \in g(C)]$, otherwise undefined

b. $[\![\sim]\!]^f(g(C)_{\langle\tau,t\rangle})([\![\phi]\!]^f{}_{\langle\tau,t\rangle}) = \{[\![\phi]\!]^g\}$

The third option in (64) how to obtain a salient alternative is the crucial one for our problematic cases. It says the following: If by simple compositional processes – that is, in particular functional application – we can obtain a semantic object matching the formal alternatives from a linguistic object whose value would not have matched the formal requirements otherwise, then this semantic object counts as salient alternative. The process is constrained in such a way that some linguistic object must serve as the actual linguistic antecedent, i.e., it must be coin-

[20] Again, this is similar to Schwarzschild's 1999 system, but can also be found in the principle *Don't Overlook Anaphoric Possibilities* argued for by (Williams 1997:603).

dexed with the ∼-operator. The actual salient alternative is obtained by applying its meaning to material provided by the context, or vice versa.

In the following subsection, I will discuss how the assumptions made so far make it possible for us to derive the presence of focus on bound pronouns in an essentially Roothian system. The crucial ingredient for the explanation of the constructions with focus on the bound pronoun will be that the present system allows for more relevant alternatives than Rooth's through the introduction of the notion of compositional reconstruction.

2.3.3 Licensing focus on bound pronouns

Recall that it was claimed above that the second sentence in (68) could in principle have at least two representations – that is, (69a) and (69b). We have seen that (69b) is problematic in Rooth's theory, and this will remain so in the present proposal. I will briefly repeat discussion of the interpretation of this LF below. But first let us turn our attention to (69a), which is the representation that I argue to license focus on the bound pronoun in (68).

(68) Every director discussed his film, and every ACTOR discussed HIS film

(69) a. $\sim C_2$ [$_{IP}$ every actor$_F$ [$\sim C_1$ [$_{VP}$ 1[t$_1$ discussed 1$_F$'s film]]]]

b. $\sim C_2$ [$_{IP}$ every actor$_F$ 1[t$_1$ discussed 1$_F$'s film]]

When deciding whether (69a) is licensed by our system, we need to consider two focus values, the one of the VP_1 and the one of IP. The lower ∼-operator activates formal alternatives of the form in (70a), whereas the higher ∼-operator activates the ones in (70b). Note that the alternatives introduced by the focus on the bound pronoun do not figure in the focus value of IP. The reason for this is that the lower ∼-operator resets the focus value. Apart from the notion of salient alternative this is the second crucial ingredient in the present account, as it prevents us from running into the problem discussed in subsection 2.2.1. In subsection 2.5.4 we will see that this is also the major drawback that Schwarzschild's 1999 proposal suffers from.[21]

[21] In Rooth's system one could also argue that the ∼-operator interpreting the focus on the restrictor is attached lower, namely to the quantifier. In this case it would not be necessary to have a further sentential ∼-operator. Nothing

(70) a. $[\![\text{VP}]\!]^f = \{\lambda x.\lambda w.discuss(w)(x, y's\ film) \mid y \in D_e\}$

b. $[\![\text{IP}]\!]^f = \{\lambda w.\forall x[P(w)(x) \rightarrow discuss(w)(x, x's\ film) \mid P \in D_{\langle e,st\rangle}]\}$

The next question one has to address is whether there are salient alternatives matching the activated formal ones in (70a) and (70b), respectively. We already know that the context makes alternatives fitting the description in (70b) salient. The real question is what the salient alternatives fitting the formal ones activated by the lower ∼-operator are. Recall that the present approach is characterized by an increase in the number of possible alternatives that can be members of $g(C)$, the so-called salient alternatives. Moreover, recall that by the modified ∼-operator (67) the salient alternatives must be used by $g(C)$. In the preceding subsection it was shown that utterance of the sentence denoting the proposition $\lambda w.kiss(w)(John, Sue)$ in most contexts makes at least also the alternative $\lambda w.like(w)(John, Sue)$ salient. In the present situation, however, generating a salient alternative through inference will not be enough. Rather, the third possibility of deriving salient alternatives must be used, namely reconstruction of an alternative from an existing linguistic object.

Let us assume a concrete situation to facilitate discussion: The directors are $\{a, b, c\}$ and the actors are $\{d, e\}$. Moreover, each of $\{a, b, c, d, e\}$ has discussed his recent film. The antecedent linguistic object for the VP in (69a) is the VP in (71). By applying its denotation to each director in the domain, we arrive at the set of propositions in (72a). This set is equivalent to the one in (72b), where the subject position is scoped out.

(71) every director [$_{\text{VP}}$ 1[t$_1$ discussed 1's film]]

(72) a. $\left\{ \lambda x.\lambda w.\text{discuss}(w)(x, x\text{'s film}) \right\}\left(\left\{ \begin{matrix} a \\ b \\ c \end{matrix} \right\}\right) = \left\{ \begin{matrix} \lambda w.\text{discuss}(w)(a, a\text{'s film}) \\ \lambda w.\text{discuss}(w)(b, b\text{'s film}) \\ \lambda w.\text{discuss}(w)(c, c\text{'s film}) \end{matrix} \right\}$

in the argument given in the text would change. The option in the text is chosen to make the system more easily comparable with Schwarzschild's 1999. As we will see in subsection 2.5.4 this approach could be characterized by claiming that focus must be checked at each branching node. In other words, one could claim that there is a ∼-operator attached to each node. Therefore resetting the semantic contribution of the lower F-mark will be essential in order to deal with the empirical problem discussed in this chapter.

b. $= \left\{ \begin{array}{l} \lambda x.\lambda w[\text{discuss}(w)(x, a\text{'s film})](a) \\ \lambda x.\lambda w[\text{discuss}(w)(x, b\text{'s film})](b) \\ \lambda x.\lambda w[\text{discuss}(w)(x, c\text{'s film})](c) \end{array} \right\}$

By this compositional process, we have derived predicates that match the formal alternatives. I.e., the members of the set in (74) are the salient alternatives that we need.

(73) $\left\{ \begin{array}{l} \lambda x.\lambda w.\text{discuss}(w)(x, a\text{'s film}) \\ \lambda x.\lambda w.\text{discuss}(w)(x, b\text{'s film}) \\ \lambda x.\lambda w.\text{discuss}(w)(x, c\text{'s film}) \end{array} \right\}$

But if the predicates in (73) are salient alternatives matching the activated formal ones, then they must be used according to the new definition of the ∼-operator (67). Put differently, $g(C)$ denotes the set in (73). If that is so, the presupposition of the lower ∼-operator is satisfied. $g(C)$ matches the activated formal alternatives. So it seems that focus on the bound pronoun in (68) is in principle licensed by our system. Before discussing the question whether AvoidF would not actually prefer the option without focus on the bound pronoun, let me briefly comment on the higher ∼-operator and the focus on the restrictor of the quantifier. In this respect the present proposal does not differ from the one discussed above. The first conjunct in (68) makes an alternative matching the formal alternatives in (70b) salient – that is, the antecedent sentence directly makes the relevant alternative salient, which is given in (74). Note also that this is the same alternative that is required to be salient for the version of (68) with the focus on the bound pronoun dropped and the lower ∼-operator absent. The reason for this is that in the present proposal the embedded ∼-operator resets the focus value of the bound pronoun so that its alternatives do not figure in the focus value relevant for the higher ∼-operator.

(74) $\left\{ \lambda w.\forall x[\text{director}(w)(x) \rightarrow \text{discuss}(w)(x, x\text{'s film}) \right\}$

A direct prediction of this approach is that the discourse in (75) should be felicitous.[22] Note that in this discourse the antecedent sentences make the alternatives that I argue are necessary for the problematic examples above directly accessible. And in this case, too, the bound pronoun can be focused. This is as expected under the present theory because all salient alternatives matching the formal ones must be used by the modified entry for the ∼-operator.

(75) Actor *a* discussed his film, and actor *b* did, too. Every DIRECTOR discussed HIS film

The other possible representation for the second conjunct in (68) – i.e., (69b) – is obviously not licensed. The reason is that the problem discussed in subsection 2.2.1 obtains. The focus value of the sentence is (76). But there are no salient alternatives matching the formal ones in the context that could be the denotation of $g(C)$. Thus (69b) is ruled out. As we already know, if the focus on the bound pronoun is left out, a felicitous representation results. In other words, we have two felicitous LFs with no focus on the pronoun[23] but only one with focus on the pronoun (provided that AvoidF does not rule the latter one out).

(76) $[\![\text{IP}]\!]^f = \{\lambda w.\forall x[P(w)(x) \rightarrow discuss(w)(x, y's\ film)] \mid y \in D_e, P \in D_{\langle e,st\rangle}\}$

We have accounted for the possibility of focus on bound pronouns in an essentially Roothian system. Note that we have not made use of a notion of contrastiveness so far. In the following subsection, we will, however, see that such a notion should be part of an analysis of contrastive focus. The way this is implemented will also allow us to account for the fact that AvoidF does not force us to choose the option without focus on the pronoun.

[22] Thanks to Klaus von Heusinger (p.c.) for reminding me of this.

[23] This is so because LF (69b) without an F-mark on the bound pronoun is, of course, also licensed. In this case the denotation of the antecedent VP is equivalent to the focus value in question. This is also where the question of AvoidF becomes important, as we will see below. The reasons is that (69a) and (69b) should be competitor LFs when it comes to AvoidF.

2.3.4 The second step in the proposal: Contrastiveness

Remember Sauerland's 1998 observation credited to Irene Heim (p.c.), and also noted by Jacobson (2000) that contrastive focus on a bound pronoun is prohibited if the domains of the quantifiers used overlap. In the following example repeated from (31) above the second quantifier quantifies over a subset of the domain of the first quantifier. Unacceptability results.

(77) *I expected every student to call his father, but only every YOUNG student called HIS father.
(Sauerland 1998:206)

The following example is another one making the same point. In a situation where some individuals satisfy both predicates used in the restrictors of the quantifiers, a discourse such as (78) is unacceptable. Note that it cannot be claimed that the domains must necessarily overlap if the pronoun is not focused, as shown by the possibility of (79). Here two mutually exclusive predicates are chosen. Nevertheless the example is fine without focus on the bound pronoun.

(78) *Situation:* John and Bill are both actors and film directors. Sam is only an actor, and Tim is only a director.
#Every actor called his father, and every DIRECTOR called HIS father

(79) Every blond student called his father, and every BLACK haired student called his father

Thus, when the bound pronoun is focused, the domains of the antecedent quantifiers must not overlap. I propose to implement contrastiveness as follows.[24] Assume that the $\sim$-operator comes with an additional presupposition that requires that the ordinary value of its sister constituent is not a member of the contextual set of alternatives. This new presupposition is the contrastiveness requirement proposed in this chapter.[25]

[24]Thanks to Irene Heim (p.c.) whose suggestions I am following here but adopting them somewhat. So all mistakes are my own, of course.

[25]This would probably amount to saying that there are at least two $\sim$-operators: One for contrastive uses as in (80), and one for non-contrastive uses such as in question-answer pairs. We can assume that the latter one is identical

(80) a. $[\![\sim]\!]^g(g(C)_{\langle st,t\rangle})([\![\phi]\!]^g{}_{\langle st\rangle}) = [\![\phi]\!]^g$
if $g(C) \subseteq [\![\phi]\!]^f$,
$\forall A_S [A_S \in [\![\phi]\!]^f \rightarrow A_S \in g(C)]$, and
$[\![\phi]\!]^g \notin g(C)$, otherwise undefined

b. $[\![\sim]\!]^f(g(C)_{\langle st,t\rangle})([\![\phi]\!]^f{}_{\langle st,t\rangle}) = \{[\![\phi]\!]^g\}$

What does this amount to in the present context? Assume that the LF for the focus sentence in (78) is as in (81).

(81) $\sim C_2$ [$_{IP}$ every director$_F$ [$_{VP} \sim C_1$ 2[t_2 called 2_F's father]]]

In what follows, I will ignore the presupposition regulating the use of salient alternatives. The new entry for the ∼-operator with the contrastiveness condition requires that the ordinary value of the sister of the lower ∼-operator is not a member of the contextual alternatives. For this to work in the present cases, we have to assume a cross-categorial semantics for the ∼-operator, just like Rooth (1985) does for *only* and *even*. This makes the denotation of the VP a partial function. The predicate-level ∼-operator is defined as in (82).[26]

(83) a. $[\![\sim]\!]^g(g(C)_{\langle\langle e,st\rangle t\rangle})([\![\phi]\!]^g{}_{\langle e,st\rangle}) = \lambda x : [\![\phi]\!]^g(x) \notin \{g(C)\}(x).[\![\phi]\!]^g$

b. $[\![\sim]\!]^f(g(C)_{\langle\langle e,st\rangle t\rangle})([\![\phi]\!]^f{}_{\langle\langle e,st\rangle t\rangle}) = \{[\![\phi]\!]^g\}$

The contextual alternatives are the salient alternatives. In the present situation these amount to the set in (85), as John, Bill, and Sam are the actors in the context. Now, the function in (84a) is only defined for individuals who with the function $\lambda y.\lambda w'.discuss(w')(y, y$*'s film)*

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to (80) with the only difference being that it misses the additional presupposition. In the following when I refer to the ∼-operator, I will have (80) in mind.

[26]The complete entry for predicate-level ∼ would be as in (i).

(82) a. $[\![\sim]\!]^g(g(C)_{\langle\langle e,st\rangle t\rangle})([\![\phi]\!]^g{}_{\langle e,st\rangle}) = \lambda x : g(C) \subseteq [\![\phi]\!]^f \wedge$
$\forall A_S [A_S \in [\![\phi]\!]^f \rightarrow A_S \in g(C)] \wedge$
$[\![\phi]\!]^g(x) \notin \{g(C)\}(x).[\![\phi]\!]^g$

b. $[\![\sim]\!]^f(g(C)_{\langle\langle e,st\rangle t\rangle})([\![\phi]\!]^f{}_{\langle\langle e,st\rangle t\rangle}) = \{[\![\phi]\!]^g\}$

applied to them are not in the set of contextual alternatives in (85), where each member in (85) is applied to that individual as well (by our definition of functional application for sets). As a consequence the function is only defined for individuals who are not actors. When the quantifier *every director* is applied to the partial function, it thus follows that no director can also be an actor.

(84) a. $[\![\text{VP}]\!]^g = \lambda x.\lambda w : \lambda y.\lambda w'[call(w')(y, y's\ father)](x) \notin \{g(C)\}(x).$
$call(w)(x, x's\ father)$

b. $[\![\text{IP}]\!]^g = \lambda w.\forall x[director(w)(x) \rightarrow call(w)(x, x's\ father)] \notin \{g(C)\}(x).$
$call(w)(x, x's\ father)]$

(85) $$g(C) = \left\{ \begin{array}{c} \lambda x.\lambda w.call(w)(x, John's\ father) \\ \lambda x.\lambda w.call(w)(x, Bill's\ father) \\ \lambda x.\lambda w.call(w)(x, Sam's\ father) \end{array} \right\}$$

This explains why (78) is infelicitous. The requirement just discussed is not satisfied. John, for instance, is a director and an actor. Thus when John is chosen to verify (84b), we notice that the proposition that John discussed John's film is a member of (85) because we also have to apply each property in (85) to *John*. I.e., the presupposition is not satisfied, and the value of (84b) is undefined. This accounts for the obligatory non-overlapping of the domains of quantifiers used in the problematic constructions discussed.[27]

Let us now turn to the question why the focus on the pronoun is not blocked by AvoidF.

[27]Note that the cross-categorial move makes it possible to attach ~ lower in the structure without affecting the outcome. This is fairly obvious when the structure in (i) is assumed, for instance. The ordinary value for v' is as in (ii). When the compositional interpretation proceeds further, though, we ultimately arrive at the same value for VP as in (84a) above. First the function in (86) applies to $g(2)$, but then abstraction over index 2 takes place. The principle of compositional reconstruction also provides the correct set of salient alternatives, as long as ~ is coindexed with a verbal node in the antecedent that denotes a unary function itself. This way it is ensured that the antecedent function can apply to the actors in the context.

(86) ~ C_2 [$_{\text{IP}}$ every director$_F$ [$_{\text{VP}}$ 2[t_2 [$_{\text{v'}}$ ~ C_1 called 2_F's father]]]]

(87) $[\![\text{v'}]\!]^g = \lambda x.\lambda w : \lambda y.\lambda w'[call(w')(y, g(2)'s\ father)](x) \notin \{g(C)\}(x).$
$call(w)(x, g(2)'s\ father)$

2.3.5 AvoidF cannot apply

It turns out that the contrastiveness requirement introduced in the preceding subsection also explains why AvoidF does not block the LF with F-mark on the bound pronoun and embedded ∼-operator. Remember what the requirement says: The ordinary value of the sister constituent of the ∼-operator must not be a member of the contextual alternatives. Consider the LF from (81) in the preceding subsection with the only difference being that the focus on the bound pronoun is left out. Otherwise, everything stays the same, and in particular there is an embedded ∼-operator present. Also remember the definition of AvoidF from subsection 2.2.3 above, repeated in (89).

(88) $\sim \mathrm{C}_2$ [$_{\mathrm{IP}}$ every director$_F$ [$_{\mathrm{VP}} \sim \mathrm{C}_1$ 2[t_2 called 2's father]]]

(89) *AvoidF for a semantics with focus values*
If both structures S_1 and S_2 satisfy focus licensing, $[\![S_1]\!]^g = [\![S_2]\!]^g$, and S_1 has more F-marks than S_2, S_2 is preferred to S_1.

Could (88) be a representation for the focus sentence in (78), not considering the particular situation given there? The problem with (88) and similar structures is that they do not satisfy focus licensing. Let us see why. The embedded ∼-operator requires that the ordinary value of its sister constituent is not a member of the contextual alternatives. Again, we get a partial function as the denotation for VP. The difference to the situation before is that the denotation of C differs. $g(C)$ must be a member of the focus value of the sister constituent of the ∼-operator. But since there is no F-mark present in this constituent, $g(C)$ will amount to the singleton in (91), i.e., the set just containing the ordinary value of the constituent under discussion.

(90) $[\![\mathrm{VP}]\!]^g = \lambda x.\lambda w : \lambda y.\lambda w'[\mathrm{discuss}(w')(y, y\text{'s film})](x) \notin \{g(C)\}(x).$
$\mathrm{discuss}(w)(x, x\text{'s film})$

(91) $g(C) = \left\{ \lambda x.\lambda w.\mathrm{discuss}(w)(x, x\text{'s film}) \right\}$

This state of affairs, however, leads to a requirement for the function in (90) that cannot be fulfilled. Since the ordinary value of the VP is the only member of $g(C)$, as has just been argued, it cannot hold that the ordinary member is not a member of $g(C)$. This has the consequence that focus on a bound pronoun is obligatory if a representation similar to the one in (88) is chosen. The observed optionality of focus on bound pronouns arises because the LF without an embedded $\sim$-operator is only licensed if there is no focus on the bound pronoun.[28]

2.3.6 Intermediate conclusion

So far we have achieved the following: It has been shown that the individual-denoting alternatives for focused bound variables are indeed all that is needed to account for the observed focusing pattern. An essentially Roothian system has been defended. It was argued that the insertion of $\sim$-operators is free, except for the sentential level. Each sentence must have a $\sim$-operator attached to it. It was seen to be crucial that an embedded $\sim$-operator resets the focus value to the ordinary value of its sister constituent. As will become clear in subsection 2.5.4, this resetting of values is essential. It has been argued that once the $\sim$-operator has activated formal alternatives, the context is scanned for all salient alternatives matching the requirements imposed by the formal alternatives. However, this search is restricted by the fact that – as in Rooth's system – the $\sim$-operator is coindexed with an antecedent constituent. The salient alternatives must be derived from the denotation of that antecedent, either by being identical to it, or by being inferred or compositionally reconstructed from it. We modified the $\sim$-operator so that each matching salient alternative must be a member of the contextual alternatives $g(C)$. Note moreover that the optionality of focus on bound pronouns has been shown to stem from a syntactic ambiguity, namely the presence or absence of an embedded $\sim$-operator. In particular, I argued that the observed contrastiveness requirement should be modeled as another presupposition introduced by $\sim$, namely one that requires that the ordinary value of the constituent

[28] Alternatively, one might be able to say that a $\sim$-operator always needs a focus to interpret in its scope. This could be implemented as a syntactic requirement. This way the representation in (88) would also be ruled out. But even if that simple solution should not go through, the present assumptions offer a way to address the question why AvoidF cannot block the F-mark on the bound pronoun.

that ~ is attached to must not be a member of the denotation of C. This was seen to result in a contradictory requirement if there is an embedded operator but the focus on the bound pronoun is left out. The contrastiveness requirement also allowed us to account for the non-overlapping domains requirement.

We now have to show that we can still explain the data which motivated the condition AvoidF in the first place under the assumptions that there are optional embedded ~-operators and that moreover the ~-operator is modified as argued in this section. Moreover, we must discuss the consequences of our approach in terms of salient alternatives. In particular, we must be sure that it does not overgenerate. This among other things will be done in the following section.

2.4 Predictions and Problems

In the present section predictions and consequences of the proposal are discussed.

2.4.1 Focus on the antecedent quantifier

It was noted above that the focus on the antecedent of the bound pronoun in conjunct two is obligatory. Consider (92), repeated from (22) above.

(92) *Every student cut his (own) arm, and every teacher cut HIS arm

The focus on *actor* in (92) cannot be dropped. Why is this? Since I am operating under the assumption that a ~-operator is attached to at least the sentential node, we will always run into the problem that no salient alternatives can be found that match the activated formal ones. For concreteness assume the LFs in (93) for the two conjuncts in (92). But the argument would still be valid, if an embedded ~-operator were to be assumed in LF (93b). The focus value for the sentence in (93b) is as in (94). There is no salient alternative that fits this requirement.

(93) a. [$_{IP}$ every director 1[t_1 discussed 1's film]]

b. $\sim C_1$ [$_{IP}$ every actor 1[t_1 discussed 1_F's film]]

(94) $[\![IP]\!]^f = \{\lambda w.\forall y[actor(w)(y) \rightarrow discuss(w)(y, x'sfilm)] \mid x \in D_e\}$

2.4.2 Overfocusing

In subsection 2.2.3 we discussed evidence suggesting that so-called overfocusing is not allowed. It was seen that focus is not optional. Overfocusing was ruled out by the condition called AvoidF. Reconsider the data form above. In short, when constituents contrast with each other, focus is obligatorily present, as shown by the contrast between B and B'. But if the constituents do not contrast, focus is forbidden, as evidenced by C and C'.

(95) A: John kissed Mary

B: Yes. And, BILL kissed SUE

B': #Yes. And, BILL kissed Sue

(96) A: John kissed Mary

C: Yes. And, BILL kissed Mary (too)

C': #Yes. And, BILL kissed MARY (too)

But we have also seen that focus on bound pronouns is in general optional. Moreover, it was claimed that more than one ∼-operator can be present in a structure. The optionality of the focus in question has been essentially reduced to a syntactic ambiguity, namely the optional presence of embedded ∼-operators. The question is whether these assumptions predict the correct pattern for the data in (95) and (96). For each of B-C' there are at least two representations that we have to consider, namely the one with a ∼-operator only at the sentential level and the one with an additional embedded ∼-operator. That is, for each of B-C' we have to consider both (97a) and (97b) where X stands for *Sue* or *Mary*, and the focus on the latter two is present in B and C, but not in B' and C'. The denotations of the relevant contextual restrictions are assumed to be as in (98). I will discuss each continuation of A in turn now.

(97) a. $\sim$ C [Bill$_F$ kissed X$_{(F)}$]

b. $\sim$ C$_2$ [Bill$_F$ [$\sim$ C$_1$ 1[t$_1$ kissed X$_{(F)}$]]]

(98) a. $g(C) = \{\lambda w.kiss(w)(John, Mary)\}$

b. $g(C) = \{\lambda x.\lambda w.kiss(w)(x, Mary)\}$

Consider B with *Sue* for X and a focus present. In case representation (97a) is chosen, the relevant focus value is as in (99a). A makes a suitable alternative salient, and therefore the requirement of $\sim$ is fulfilled. Moreover, the contrastiveness requirement of $\sim$ is fulfilled, as well; the ordinary value of B is not a member of (98a). Contrastive focus is licensed. Does AvoidF prefer to drop the focus on *Sue*, as in B'? The answer is negative. $g(C)$ in (98a) is not a member of the resulting focus value (99b), and A presumably does not make an alternative salient that could satisfy the requirement imposed by the focus value.

(99) a. $[\![\text{B}]\!]^f = \{\lambda w.kiss(w)(x, y) \mid x, y \in D_e\}$

b. $[\![\text{B'}]\!]^f = \{\lambda w.kiss(w)(x, Sue) \mid x \in D_e\}$

In case the representation in (97b) is chosen for B, a problem obtains. The focus value for the VP is as in (100ai). Again, A makes a suitable alternative salient, namely the property of kissing Mary (98b). The contrastiveness requirement is also satisfied, as the property of kissing Sue is not a member of (98b). The problem obtains when the lower $\sim$-operator resets the focus value. This has the consequence that the alternatives introduced by focus on *Sue* are not part of the focus value of the sister of the higher $\sim$-operator.[29] There is no alternative made salient by A that is a member of the focus value in (100aii). For essentially the same reason, representation (97b) leads to infelicity in the case of B'. We just need to consider the lower $\sim$-operator. The focus value for the VP is now the singleton in (100b). The property of kissing Mary, made salient by A, is not a member of that set. This means that only B – as licensed by structure (97a) – is an option as continuation of A, even under the present assumptions.

[29]Note that here it would not do, to just attach the higher $\sim$-operator lower. This would result in appending it directly to the F-marked constituent *Sue*, which is prohibited.

(100) a. (i) $[\![\mathrm{B}_{VP}]\!]^f = \{\lambda x.\lambda w.kiss(w)(x, y) \mid y \in D_e\}$

(ii) $[\![\mathrm{B}_{IP}]\!]^f = \{\lambda w.kiss(w)(x, Sue) \mid x \in D_e\}$

b. $[\![\mathrm{B'}_{VP}]\!]^f = \{\lambda x.\lambda w.kiss(w)(x, Sue)\}$

Consider now C with representation (97a). The focus value relevant for the ∼-operator is (101a), again. $g(C)$ in (98a) fits this description. Moreover, the denotations of A and C satisfy the contrastiveness requirement. The problem is, however, that AvoidF prefers the same structure without F-mark on *Mary* – that is, it prefers C'. The resulting focus value is given in (101b). The alternative made salient by A is also a member of that value. Thus, that option is to be chosen.

(101) a. $[\![\mathrm{C}]\!]^f = \{\lambda w.kiss(w)(x, y) \mid x, y \in D_e\}$

b. $[\![\mathrm{C'}]\!]^f = \{\lambda w.kiss(w)(x, Mary) \mid x \in D_e\}$

If representation (97b) is chosen for C, the focus value relevant for the lower ∼-operator is as in (102ai). A makes an appropriate alternative salient – the property of kissing Mary (98b). The focus value used by the higher ∼-operator, on the other hand, is as in (102aii). Again, a suitable salient alternative is available – the proposition that John kissed Mary. AvoidF, of course, prefers the structure without F-mark on *Mary* which leads to the focus value in (102b) for the lower ∼-operator to use. The property of kissing Mary is a member of that singleton. The focus value used by the higher ∼-operator is again identical to (102aii). The proposition denoted by A is a member of that value. The problem lies, however, in both cases with the ordinary value of the sister of the lower ∼-operator. In particular, it does not satisfy the contrastiveness requirement, as it is identical to $g(C)$ in (98b). This means that structure (97b) is blocked for both the option with and the one without focus on *Mary*. This in turn means that only C' under the representation (97a) is a possible option.

(102) a. (i) $[\![\mathrm{C}_{VP}]\!]^f = \{\lambda x.\lambda w.kiss(w)(x, y) \mid y \in D_e\}$

(ii) $[\![\mathrm{C/C'}_{IP}]\!]^f = \{\lambda w.kiss(w)(x, Mary) \mid x \in D_e\}$

b. $[\![\text{C'}_{VP}]\!]^f = \{\lambda x.\lambda w.kiss(w)(x, Mary)\}$

We have thus explained the patterns that originally motivated AvoidF. It should be added that the focus on *Bill* cannot be dropped in any of the continuations. The reason is that we would not find a suitable salient alternative for the sentence anymore, as A has *John* in the subject position. The proposition denoted by A would not be a member of any of the resulting focus values. The data of overfocusing therefore highlight the importance of the sentential ∼-operator. If this operator were to be made optional together with all other ∼-operators, the theory would not be descriptively adequate any longer. It goes without saying that the present subsection is not a complete treatment of overfocusing, but it goes a considerable way to explain some crucial data. I must leave further investigation of this phenomenon to future research, however.

2.4.3 Salient alternatives

Let us return to the question whether the use of salient alternatives that are generated by the process of compositional reconstructions is not too permissive. By incorporating the notion of salient alternative, the present proposal makes more alternatives available that are relevant for focus licensing. We have seen that this was crucial for the account of the basic data. This has the consequence that we should find both more cases of focus licensed as well as more cases of nonfocusability than in Rooth's 1992b original theory.[30]

Let us now discuss some further evidence for the assumption that alternatives are provided by pragmatics. Consider the discourse in (103). We notice that *Bill* must be focused, whereas neither *likes* nor *Sue* can bear stress (B)-(B"). We furthermore note that none of these objects, nor any of the complex constituents formed by them is given by A's utterance. So why must *Bill* be focused then? The answer seems to be that A's utterance makes salient by implicature the proposition that *John likes Sue*. If this is the case, it follows under our assumptions that *Bill* must be focused. Since salient alternatives matching the activated formal alternatives must be used, focusing *Bill* derives the strongest possible focus value such that the salient alternative

[30]It is not entirely clear how the present proposal compares to Schwarzschild's 1999 in this respect.

John likes Sue is a member of that focus value.[31]

(103) A: John kissed Sue

B: I thought that BILL likes Sue

B': #I thought that Bill LIKES Sue

B": #I thought that Bill likes SUE

The following example makes a parallel point. In the given situation, A's utterance makes salient, again by implicature, the proposition that John still lives in Paris. And, again focus on *left* is obligatory, as the difference between B and B' shows. If salient alternatives must be used, this is as expected.[32]

(104) *Situation:* We are going to meet John in France. We discuss where in particular we will meet him.

A: We will meet John in Paris

B: I thought John LEFT Paris

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[31]It would, of course, also be possible to focus the whole utterance B, so that the utterance counts as whole new. This option, however, appears to be disfavored for the reason that such an utterance would presumably not be the most relevant utterance for the topic of discussion. This remark also applies to the next example.

[32]Sigrid Beck (p.c.) raises the following question. In order to license the correct focus in continuation B of example (103), I said that the proposition *John likes Sue* should be made salient by uttering A. If this is allowed, a salient alternative matching the formal ones activated by B is available. The question is whether this view would derive truth conditions for an example like (104) that are too strong. The intuitive meaning of (104) is that no one other than Mary is liked by Bill. That is, all the alternatives of the form *Bill likes x* where *x* is an individual alternative to Mary should be false. Now Beck asks whether the present proposal wouldn't make it possible that also alternatives of the form *Bill kissed x*, *x* an individual different from Mary, must be false. This is not the case because the requirement of the present theory is essentially still as it was in Rooth's: Each salient alternative different from *Bill likes Mary* matching the activated formal ones must be false. But that can only be alternatives of the form *Bill likes x*, *x* an individual.

(i) Bill only likes MARY

In fact, we observe even in cases of association with focus that alternatives are made salient by a preceding utterance that are different from the preceding utterance, but that match the requirements of the activated formal alternatives. (104) is a case in point.

(ii) A: John kissed Mary.
B: Really? I thought John only likes SUE

B': #I thought John left PARIS

The following example is more directly relevant to the topic of the present paper. Consider A's utterance under the bound variable reading. In this situation in order for B's utterance to contrast with A's, there is obligatorily focus on both *John* and *Mary*. B' is an infelicitous utterance.

(105) A: Every student likes his mother

B: Yes. And, JOHN likes MARY's mother

B': #Yes. And, JOHN likes Mary's mother

Let us briefly consider what the standard Roothian theory would have to say about the situation posed by (105). In principle one could assume at least two LFs, just as proposed in the present paper. Either there is only one ∼-operator attached to the sentential level as in (106), or there is a further embedded one. The ∼-operators are coindexed with constituents of A's utterance.

(106) a. [every student [1[t_1 likes 1's mother]]]$_4$

b. $\sim_4$ C [JOHN$_F$ likes MARY$_F$'s mother]

(107) a. [every student [1[t_1 likes 1's mother]]$_5$]$_4$

b. $\sim_4$ C_2 [JOHN$_F$ [$\sim_5$ C_1 [1 [t_1 likes MARY$_F$'s mother]]]]

Now consider the focus values for the sentential levels of (106b) and (107b), respectively. Let us assume that proper names can also be optionally treated as quantifiers (Montague 1974). This has the consequence that all objects of type $\langle\langle e, st\rangle st\rangle$ can serve as alternatives to the proper names, which seems to be required in order to let *John* and *every student* contrast with each other. In (106b), there is no embedded ∼-operator that could reset the focus value. Because of this the alternatives contributed by the focus on *Mary* figure in the sentential focus value, as (108) shows. In (107b), however, the embedded ∼-operator does reset the focus value. The resulting sentential focus value is (109). But even though proper names can function as quantifiers under the present assumptions, the ordinary value of the antecedent sentence is neither

a member of (108) nor of (109). The reason is clear, bound variable interpretations are not members of the respective focus values.

(108) $[\![(106b)]\!]^f = \{Q(\lambda x.\lambda w.like(w)(x, y'\,s\ mother) \mid y \in D_e, Q \in D_{\langle\langle e,st\rangle st\rangle}\}$

(109) $[\![(107b)]\!]^f = \{Q(\lambda x.\lambda w.like(w)(x, Mary'\,s\ mother) \mid Q \in D_{\langle\langle e,st\rangle st\rangle}\}$

The only way to circumvent this problem and thus license the foci in B would be to have the higher ∼-operator directly adjoined *John*. This, however, seems highly unlikely for the following reason, already mentioned before: The resulting requirement on the context would be too weak. Therefore attaching a ∼-operator directly to a focused constituent should be prohibited. But assume for the sake of argumentation that we allow for this possibility.[33] Doing so would lead, however, to a second problem: One possible LF under the traditional account must be (111). Here the ∼-operator evaluating the focus contribution by the F-mark on *John* is directly adjoined to that constituent. The one responsible for focus on *Mary* is adjoined to VP. It must be coindexed with the antecedent VP not including the binder. The reason for the latter assumption is that in the traditional theory for focus on *Mary* to be licensed there must be an individual that could serve as an antecedent. Only if the VP-constituent not involving the binder is assumed to be the antecedent, will the resulting VP-denotation be a member of the focus value in (112), the focus value of the VP in (111).

(111) [∼ C_2 [JOHN$_F$]] [∼ C_1 1[t_1 likes MARY$_F$'s mother]]

(112) $[\![VP]\!]^f = \{\lambda x.\lambda w.like_w(x, y'\,s\ mother) \mid y \in D_e\}$

But this predicts that both the foci on *Mary* on *John* are optional. The reason is that in both cases there is no dominating ∼-operator that would require focus on any of the larger constituents. As

[33]Note also that such a move would open the door to sentence internal licensing of focus in infelicitous examples like (i). If the ∼-operators were adjoined directly to the F-marked constituents, the foci should be licensed because the individuals contrast with each other.

(110) #JOHN kissed SUE

soon as we require a dominating ∼-operator, say at the sentential level, we run into further problems. Consider the LF in (113) with two ∼-operators involved; one ∼-operator on *John* and one at the sentential level. Since the operator evaluating focus on *John* resets the focus contribution on *John*, the focus value for IP would then be as in (114). Clearly, the value of the antecedent sentence is not a member of (114), bringing us back to our original problem.[34]

(113) $\sim C_2$ [$\sim C_1$ [JOHN$_F$]] 1[t_1 likes MARY$_F$'s mother]

(114) $[\![\text{IP}]\!]^f = \{\lambda w.like_w(John, y's\ mother) \mid y \in D_e\}$

The result is the following: The higher ∼-operator must not be directly attached to *John* but to the sentential level. This ensures that neither of the foci is optional. Furthermore, our process of compositional reconstruction is necessary. The reason for this is that only this way we can make sure that there are salient alternatives in the context that match the formal ones activated by the sentential ∼-operator – i.e., alternatives where the semantic contribution of the F-marks on *John* and *Mary* requires for propositional alternatives with individuals in the slots occupied by *John* and *Mary*. Assume, for instance, the LF in (106b) again. Assume moreover that the sentential ∼-operator is coindexed with the VP including the binder in the preceding sentence. Then, in the present proposal, the antecedent VP makes alternatives of the form *student a likes a's mother* available, where *a* is a particular student, when the denotation of the VP is applied to *a*. All such alternatives have individual denoting expressions in the positions that contrast with *John* and *Mary*. It is predicted that there must be foci on the latter two. B' in particular is ruled out. The contrastiveness requirement can, of course, be easily satisfied as well. It should also be noted that the present proposal does not make a difference between such examples and the ones discussed in the previous section.

Remember that salient alternatives are dependent on the meaning of an actual linguistic object that the ∼-operator is coindexed with. We said that this object constrains the available salient alternatives. In particular, the account makes the direct prediction that if the linguistic

[34]Remember that we must require that the ∼-operator resets the focus value. Otherwise we could not account for focus on bound pronouns anymore and probably also not for other cases.

object cannot deliver a suitable salient alternative because even compositional reconstruction is not enough, focus should not be licensed. Consider (115).[35]

(115) ??Every doctor is a donkey beater, and every LAWYER beats HIS donkey

We notice that stress on the bound pronoun is distinctively odd. This might come as a surprise because the meaning of the antecedent sentence seems to be pretty close to the cases that we started our discussion with. It turns out that the present account has a handle on (115) and similar examples. If we assume that the LFs for the antecedent sentence and the focus sentence are as in (116a) and (116b), respectively, it is easy to see what goes wrong in (115). The problem is that there is no way to get from the ordinary value of the antecedent VP to a value that matches the formal alternatives. The denotation of the VP $\lambda x.\lambda w.donkey - beater(w)(x)$ is not of the right sort. Thus no salient alternative can be obtained from (116a).

(116) a. [every doctor [1[t_1 is a donkey beater]]$_2$]$_3$

b. $\sim_3$ C_2 [every lawyer$_F$ [$\sim_2$ C_1 1[t_1 beats 1_F's donkey]]]

On the other hand, focus on the bound pronoun in (117) is allowed. Thus according to the present approach the LF for the antecedent sentence must allow one to derive salient alternatives satisfying the formal requirements. A functional reading seems to be the key to understanding why (117) is licensed. Assume that the LFs are as in (118). Here the donkey-of-function applies to a bound variable. Thus one can derive salient alternatives of the correct form because the ordinary value of the VP in the antecedent sentence is parallel to the ones for the examples considered in the preceding sections. However, it must be made sure that the indefinite article is not interpreted as quantificationally but rather its interpretation is subject to the assignment to a numerical index (Heim 1982). Otherwise we could not derive alternatives matching the formal ones. I.e., the LFs would be as in (118), where x and y are numerical indices. y is the index that introduces the referent for the indefinite phrase *a donkey*, whereas x is the index that

[35]Thanks to Gennaro Chierchia (p.c.) for bringing up the question what my proposal would do with data such as (115) and (117).

the function *donkey-of* applies to. This, in principle, also allows the bound reading, where x is replaced by the index 1 and thus gets abstracted over.

(117) Every doctor beat a donkey, and every LAWYER beat HIS donkey

(118) a. [every doctor [1[t_1 beat donkey$_y$-of x]]$_2$]$_3$

b. $\sim_3$ C_2 [every lawyer$_F$ [$\sim_2$ C_1 1[t_1 beat 1_F's donkey]]]

Now consider the following cases brought to my attention by Noam Chomsky (p.c.). We notice that stress on the two arguments is only licensed when the relation switches, i.e., when the arguments switch places. Moreover the antecedent sentence does not directly make a value available that is either a member of the focus value for (119bi) or (119bii). So the antecedent serving as salient alternative has to be accommodated through contextual entailment similar to other examples that we have seen before. But what is prohibited is that accommodation proceeds in such a way that an alternative is made salient that would license the foci in (119bii). That is, when accommodating a salient alternative through contextual entailment, the agent-patient relation must stay the same as in the actual linguistic object that the $\sim$-operator is coindexed with.

(119) a. John kissed Mary,

b. (i) ... but SHE dislikes HIM

(ii) #... but HE dislikes HER

I am, however, not sure whether this is the correct generalization. In particular, the principle AvoidF seems to rule out (119bii). To see this we have to first complete the paradigm. In particular, notice that (120) is a felicitous continuation of (119a). How does AvoidF block (119bii) then? Since both (120) and (119bii) satisfy the focus principle – that is the proposition that John kissed Mary is an appropriate antecedent for them[36] – and moreover (120) has less

[36]The proposition that John kissed Mary is a member of both the focus values in (i) and (ii), corresponding to the focus values of (119bii) and (120), respectively.

(i) $[\![(119\text{bii})]\!]^f = \{\lambda w.dislike(w)(x,y) \mid x,y \in D_e\}$

F-marks than (119bii), the former must be preferred to the latter.

(120) . . . but he DISLIKES her

I therefore conclude that leaving the supply of contextual alternatives to what is essentially in the context or can be inferred from it, is not a drawback of the present theory, but rather a virtue. It allows us to deal with examples of focusing where the classical account would be disadvantageous.

2.4.4 Association with focus on bound pronouns again

In the preceding section it was claimed that contrastive focus on bound pronouns is dependent on there being present an embedded ∼-operator. This allowed us to assume that the alternatives introduced by focus on bound pronouns are individuals. This approach also extended to cases of association with focus on bound pronouns such as (121), where *only* is embedded itself. We said that since *only* does not associate directly with focus, but an intervening ∼-operator does, the assumptions made for contrastive focus and for association with focus can stay the same.

(121) Every boy only kissed HIS girlfriend

But one might wonder whether the present analysis runs into problems with examples such as (122). Here *only* is attached to the matrix level. The propositional entry assumed for *only* is repeated in (123). This entry makes it necessary that the ∼-operator interpreting focus is immediately below *only*. This, however, has the consequence that the ∼-operator cannot be in an embedded position – that is, it must be above the quantifier binding the focused pronoun.

(122) I only said that every actor discussed HIS film

(123) $[\![\text{only}]\!]^g(g(C)_{\langle\langle st\rangle t\rangle})(p_{\langle st\rangle})(w) = 1$ iff $\forall q \in g(C)[q(w) = 1 \rightarrow p \subseteq q]$
if $p(w) = 1$, otherwise undefined

(ii) $[\![(120)]\!]^f = \{P(John, Mary) \mid P \in D_{\langle e\langle e,st\rangle\rangle}\}$

We can therefore assume an LF such as (124) for (122). The assertive component for (124) is given in (125). Combined with the presuppositional component in (126), this is intuitively what we want for the example in (122). All alternatives in $g(C)$ not entailed by the speaker having said that every actor discussed his own film should be false. That is, each alternative where the bound pronoun is replaced with an individual should be false. Moreover it is presupposed that the speaker has said that every actor discussed his own film. This is the correct result, it appears.[37]

(124) only C [~ C [I said [every actor 1[t_1 discussed 1_F's film]]]]

(125) *Assertive component of (124)*

$$[\![(124)]\!]^g(w) = \forall p \in g(C)[p(w) \rightarrow \lambda w'.say(w')(speaker, (\lambda w''.\forall x[actor(w'')(x) \rightarrow discuss(w'')(x, x's\ film)])) \subseteq p]$$

(126) *Presuppositional component of (124)*

a. $g(C) \subseteq \{\lambda w.say(w)(speaker, (\lambda w'.\forall x[actor(w')(x) \rightarrow discuss(w')(x, y's\ film)]))(w) \mid y \in D\}$

b. $say(w)(speaker, (\lambda w'.\forall x[actor(w')(x) \rightarrow discuss(w')(x, x's\ film)]))$

This result can, of course, be replicated with other focus sensitive operators such as *even*. We have to conclude that association with focus on bound pronouns by matrix ~-operators is not generally a problem.

[37] In addition to the de dicto interpretation discussed in the text, it appears to be possible to scope the quantifier over the embedding verb *say* to create a de re interpretation. The LF would be as in (i). Without going into detail, it should be noted that the present proposal can, of course, also account for this situation. The interpretation associated with (i) is the following: For each particular actor a the speaker said that a discussed a's film, and the speaker did not say that a discussed anyone else's film. In addition to this difference to the example discussed in the text the alternatives activated also differ. The presupposition added by the ~-operator is $g(C) \subseteq \{\lambda x.\lambda w.$say(I,$(\lambda w'.$discuss$(w')(x, y$'s film)$]))(w) \mid y \in D\}$. The contribution of *only* is that for each actor a the only alternative in $g(C)$ that leads to truth when applied to a is the alternative $\lambda x.\lambda w.$say(I,$(\lambda w'.$discuss$(w')(x, a$'s film$)))(w)$. Note that for each actor a applying this property to a is entailed by applying the property in the prejacent to a. This appears to be correct.

(i) [every actor] [only C [~ C [1[I said [t_1 discussed 1_F's film]]]]]

2.5 Comparison with other proposals

2.5.1 Underlying functions

Sauerland (2000, 2008) offers an account to focus on bound pronouns where the pronoun is more complex than assumed in the discussion so far.[38] In particular, he argues for an optional E-type analysis for bound pronouns along the lines suggested by Cooper (1979) for standard E-type pronouns (also cf. Heim and Kratzer (1998)). This means that there is a silent function variable of type $\langle et \rangle$ which applies to the bound variable. For the discussion to follow I will assume the representation in (127) for such bound pronouns. The NP denotes the function variable. It is coindexed with an antecedent NP – in the cases to be discussed the NP in the restrictor of the quantifier. I.e., it gets its denotation from the antecedent NP.[39] The interpretation of the definite article is such that it makes the denotation of the function variable a presupposition on the bound variable (128). In other words, the value of the variable to be bound is only defined, if the denotation of the NP supplied by the NP in the restrictor of the quantifier is true of it (after Sauerland's 2000 (24)).

(127) $[\text{the}_i\ \text{NP}_j]$

(128) $[\![\text{the}_i\ \text{NP}_j]\!]^g$ defined if $[\![\text{NP}_j]\!]^g(g(i)) = 1$
if defined $g(i)$

For the reasons reviewed in subsection 2.2.2.2 Sauerland assumes that in case a bound pronoun is stressed, the VPs including the binder must contrast and not only the pronouns without the binder. This means that the two sentences in an example like (129) would have the LFs in

[38] Also cf. Elbourne (2005) who follows Sauerland to a large extent. The proposal offered by Jacobson (2000) is similar to the one by Sauerland, although couched in a variable-free semantics. Crucially, though, in her account the contrasting pronouns used are assumed to denote the identity function over different contrasting domains. This would also run into the problem discussed in subsection 2.5.2 below.

[39] In other words, the NP in the restrictor of the quantifier functions as the syntactic antecedent for the NP in the pronoun indicated by coindexation (cf. the discussion in Heim (1990) and (Chierchia 1990:158f.) especially). This could, for instance, be done by treating pronouns as cases of ellipsis (cf. Heim (1990), Elbourne (2005) a.o.). Sauerland (2008) himself argues against an ellipsis analysis, but this is immaterial to the present discussion. For simplicity, I will present the semantic content of the NP inside the pronoun syntactically.

(130) if we assume Rooth's 1992b traditional theory of focus interpretation. There are two ∼-operators, because we want the VPs to contrast. Note that the F-mark is represented on the NP in both the antecedent and the pronoun. In other words the restrictor properties in the quantifiers contrast with each other, and the properties in the definite descriptions also contrast with each other.

(129) Every student cut his (own) arm, and every TEACHER cut HIS arm

(130) a. [[every student$_4$] [1[t$_1$ cut [[the$_1$ student$_4$]'s arm]]]$_8$]$_9$

b. [∼$_9$ C$_2$ [every teacher$_{5,F}$] [∼$_8$ C$_1$ 1[t$_1$ cut [[the$_1$ teacher$_{5,F}$]'s arm]]]]

Since the interpretation of the NP in the pronoun serves as a presupposition for the bound variable, it follows that both VPs in (130) denote partial functions. In particular, they denote the partial functions in (13a) and (13b), respectively. Thus (13a) is only defined for individuals who are students, whereas (13b) is only defined for teachers.

(131) a. $\lambda x.\lambda w$:student$(w)(x)$.cut$(w)(x, x$'s arm)

b. $\lambda x.\lambda w$:teacher$(w)(x)$.cut$(w)(x, x$'s arm)

Consider now the focus value of the VP in (130b). This contains all the predicates of the form *x cut x's arm* with various definedness conditions. Since the F-mark in (130b) is on the NP inside the pronoun, the focus value has the denotation of the NP replaced with all its alternatives. According to Rooth's semantics for the ∼-operator, $g(C_1)$ must be a subset of (132). The context provides one function that is a member of (132), namely (13a). Moreover (13a) and (13b) contrast with each other. Thus focus on the pronoun should be licensed.

(132) $[\![\text{VP}]\!]^f = \{P : \exists Q[P = \lambda x.\lambda w. : Q(w)(x).\text{cut}(w)(x, x\text{'s arm})]\}$

What about the higher ∼-operator? Let us return to the standard entry for the ∼operator: It resets the focus value of its immediately dominating node to the ordinary value of its sister constituent

(cf. Rooth (1992b) and especially (Beck 2006:15f.)). (133) is the entry for the operator in this account.

(133) a. $[\![[_X \sim \text{C}\ [_Y \ldots]]]\!]^g = [\![[_Y \ldots]]\!]^g$
if $g(C) \subseteq [\![\ [_Y \ldots]]\!]^f$, otherwise undefined

b. $[\![[_X \sim \text{C}\ [_Y \ldots]]]\!]^f = \{[\![[_Y \ldots]]\!]^g\}$

The consequence of this is that the lower ∼-operator consumes the alternatives contributed by the lower F-mark. The latter can therefore not contribute anymore to any focus value higher than the lower ∼-operator. Thus the higher ∼-operator only evaluates the higher F-mark. In other words, the focus value of the TP is as in (134). Again, $g(C_2)$ must be a subset of that focus value. But this time the value of the antecedent TP is not a member of the set in (134) because (134) restricts the possible properties in the restrictor of the quantifier to *teacher*. Thus, focus on the quantifier should not be licensed.

(134) $[\![\text{TP}]\!]^f = \{p : \exists P[p = \lambda w.\forall x[P(w)(x) \rightarrow \text{teacher}(w)(x).\text{cut}(w)(x, x\text{'s arm})]\}$

The obvious remedy for this is to change the semantics of the ∼-operator. In particular, we do not require it to reset the focus value. Rather the focus value of its immediately dominating constituent would be the focus value of its sister:[40]

(135) a. $[\![[_X \sim \text{C}\ [_Y \ldots]]]\!]^g = [\![[_Y \ldots]]\!]^g$
if $g(C) \subseteq [\![[_Y \ldots]]\!]^f$, otherwise undefined

b. $[\![[_X \sim \text{C}\ [_Y \ldots]]]\!]^f = [\![[_Y \ldots]]\!]^f$

This option allows for the focus on the quantifier, because now the focus value of the TP in (130b) is as in (136). The ordinary semantic values of the antecedent TP (130a) is a member of (136). Moreover, the denotations of the sentences in question contrast with each other.

[40]This in itself is a questionable move, as it seems that foci are in most cases not accessible once evaluated. Another possibility would be to adjoin the higher ∼-operator to the QNP itself. All that would be required in this case is that there is a contrasting QNP in the context, which is satisfied.

(136) $[\![\text{TP}]\!]^f = \{p : \exists P.\exists Q[p = \lambda w.\forall x[P(w)(x) \rightarrow Q(w)(x).\text{cut}(w)(x, x\text{'s arm})]\}$

But remember that there must be a principle like AvoidF active that tries to minimize the number of foci. Although, this principle was introduced for Schwarzschild's 1999 givenness-based account, it should also be part of a system making use of focus values. Otherwise Rooth's 1992b account would predict that in case one F-mark is licensed, one is free to use more than that one. This, as we know, however, is not the case. For present purposes we can assume the formulation of AvoidF given in (35) above, repeated as (137), which is a straightforward implementation of Schwarzschild's principle. What this condition says is that if there are two structures with the same interpretation such that in both cases all the foci are licensed, the one with the fewer number of F-marks is preferred.

(137) *AvoidF for a semantics with focus values*
If both structures S_1 and S_2 satisfy focus licensing, $[\![S_1]\!]^g = [\![S_2]\!]^g$, and S_1 has more F-marks than S_2, S_2 is preferred to S_1.

Consider, now, what happens when one drops the F-mark on the bound pronoun, but otherwise we leave the LFs as they were before. In this case we get (138). Note that the embedded ∼-operator is also left out for simplicity. Note, furthermore, that (138b) is a competitor LF to (130b).

(138) a. [[every student$_4$] [1[t$_1$ cut [[the$_1$ student$_4$]'s arm]]]]$_9$
b. [∼$_9$ C [every teacher$_{5,F}$] [1[t$_1$ cut [[the$_1$ teacher$_5$]'s arm]]]]

The focus value of the TP in (138b) is as in (139). This is the same as the focus value of the TP with F-mark on the bound pronoun in (134) where the ∼-operator is assumed to reset the focus value. Thus we know already that the antecedent TP is not a member of (139). I.e., the structure in (138b) does not license its F-mark, and therefore AvoidF cannot apply. In other words, complex pronouns only allow for the option with the F-mark on the bound pronoun.

(139) $[\![\text{TP}]\!]^f = \{p : \exists P[p = \lambda w.\forall x[P(w)(x) \rightarrow \text{teacher}(w)(x).\text{cut}(w)(x, x\text{'s arm})]\}$

But how is the optionality of stress on the bound pronoun accounted for then? Sauerland assumes that in addition to the version with complex pronouns there can be LFs with simple pronouns. Assume we replace the complex pronouns in both the antecedent and the utterance with plain pronouns and that there is no F-mark on the pronoun. Without going into too much detail, it is clear that the focus value of the TP to be evaluated is as in (140), i.e., there is no restriction on the properties in the restrictor of the quantifier. Thus both the ordinary value of the antecedent and the utterance are members of this focus value. Focus on the quantifier should be licensed. Moreover, adding another F-mark to the pronoun is prohibited, because of AvoidF. I.e. a plain-pronoun LF licenses only the F-mark on the quantifier. This way the optionality is accounted for by Sauerland's system.

(140) $[\![\text{TP}]\!]^f = \{p : \exists P[p = \lambda w.\forall x[P(w)(x) \rightarrow \text{cut}(w)(x, x\text{'s arm})]\}$

Sauerland's system can thus correctly describe the pattern we find. In the following subsection I discuss a complication resulting from the assumption that focused bound pronouns are necessarily complex.

2.5.2 A problem for bound E-type pronouns

We start by noting that additive *too* in the second conjunct is possible with a non-stressed bound pronoun, but also with a stressed bound pronoun:

(141) a. Every director discussed his film, and every PRODUCER discussed HIS film, too

b. Every director discussed his film, and every PRODUCER discussed his film, too

We follow the treatment of *too* laid out in (Heim 1992:189), an extension of Kripke's semantics for it (for a more recent account along these lines cf. Geurts and van der Sandt (2004)). According to this view, *too* when adjoined to some LF associates with an F-marked constituent X

and presupposes that somewhere in the context there is an alternative Y to the denotation of X different from X such that when X is replaced by Y in the LF truth results. This means that *too* is essentially anaphoric. Consider the entry for *too* in (142).

(142) $[\![[_\phi \ldots X_F \ldots]\ \text{too}_i]\!]^g(w)$ = defined iff $Y_i \in [\![X]\!]^f$, $[\![Y]\!]^g \neq [\![X]\!]^g$ and
$[\![[_\phi \ldots Y_i \ldots]]\!]^g(w) = 1$
if defined $[\![[_\phi \ldots X_F \ldots]]\!]^g(w)$

Consider what this does for a simple example like (143), with the F-mark and coindexing as indicated. (142) requires that there is an alternative to $[\![\text{Bill}]\!]^g$ such that the property $[\![\text{kissed Mary}]\!]^g$ is true of that alternative. *John* is co-indexed with *too* and thus serves as the alternative individual. Since the first conjunct states that John kissed Mary, the presupposition of *too* is satisfied. The whole sentence says that in addition to John, Bill kissed Mary.

(143) John_i kissed Mary, and BILL_F kissed Mary, too_i

This semantics for *too* can deal well with (141b) straightforwardly, which does not have complex bound pronouns according to Sauerland. The underlying LFs would be as in (144). Here *too* is co-indexed with *director* and associates with the focus on *producer*. The requirement is thus that $[\![\text{director}]\!]^g$ is a non-identical alternative to $[\![\text{producer}]\!]^g$, which it is. Moreover, it is required that the denotation of the LF in (144b) where we replace *director* for *producer* is true. This is satisfied, as well by the first conjunct. Thus (141b) is completely parallel to (143).

(144) a. every director_5 1[t_1 discussed 1's film]
b. every producer_F 1[t_1 discussed 1's film] too_5

Let us now see whether (141a) is also predicted. We assume the underlying-functions analysis introduced in the preceding subsection. Again, *too* requires that $[\![\text{director}]\!]^g$ is an alternative to $[\![\text{producer}]\!]^g$. And it requires that the denotation of the LF in (145b) where we replace *director* for *producer* is true – that is, $[\![\text{every director}]\!]^g$ applied to the partial function denoted by the

VP in (145b) – that is, when applied to $\lambda x.\lambda w$:*producer*$(x)(w)$.*discuss*$(x,$ *x's film*$)(w)$ – should lead to truth. The first conjunct, however, does not guarantee this, as it says that every director discussed his own film. Thus the LFs in (145) should lead to undefinedness.

(145) a. every director$_5$ 1[t$_1$ discussed [[the$_1$ director]'s film]]

b. every producer$_F$ 1[t$_1$ discussed [[the$_1$ producer$_F$]'s film]] too$_5$

An obvious way to remedy this is by imposing focus association with both instances of *producer* moreover requiring co-indexing of *too* with both instances of *director*. This would lead to the correct presupposition. Now, it is required that the meaning of both *director*-instances when replacing both *producer*-instances, should lead to truth.

(146) a. every director$_5$ 1[t$_1$ discussed [the$_1$ director$_7$]'s film]

b. every producer$_F$ 1[t$_1$ discussed [the$_1$ producer]$_F$'s film] too$_{5,7}$

The problem with these assumptions is that it predicts the following sentence to be good under the interpretation in (147b). *too* should be able associate with both F-marked constituents. When replacing each of them with the antecedents that are coindexed with *too*, truth should result. The problem seems to be that *too* simply does not associate with two foci at once. If (147) is good at all, it marginally has the interpretation in (147b). Here *Bill* is contrastively stressed, whereas *too* associates with focus on *Sue*. The antecedent for *Sue* is contextually provided – that is, *Mary* functions as antecedent. But (147) cannot have the interpretation in (147a), because multiple association with focus is prohibited for *too*.

(147) John$_6$ kissed Mary$_8$, and BILL$_F$ kissed SUE$_F$, too$_{6,8}$

a. #'John kissed Mary, and Bill kissed Sue.'

b. ?'John kissed Mary, and Bill kissed Mary and in addition Sue.'

Satoshi Tomioka (p.c.) reminds me that the restriction of *too* being able to associate with only one focus has already been noted by Kaplan (1984).

(148) a. *Jo had fish and Mo had soup too.

b. Jo had fish and Mo had soup.

(Kaplan 1984:510)

In other words, the LFs in (146a) and (146b) which were used to address the problem created should not be available because of the restrictions inherent to *too*. This has the consequence that the presupposition of *too* in (141a) should not be satisfied, and the sentence should be a presupposition failure under the F-marking indicated. But it is acceptable. The VPs in examples like (141a) should count as having the same denotation, they should not be modeled as contrasting partial functions. I therefore conclude that the acceptability of (141a) argues against an approach to stress on bound pronouns making use of underlying functions. Note that it might still turn out that complex pronouns might be needed for other reasons (cf. Elbourne (2005) for instance). But, at least, for the interpretation of contrastive focus on bound pronouns, underlying functions should not be essential.

It should be clear that the present account makes the correct predictions with respect to data involving *too*. Since the present account does not rely on bound E-type pronouns, a problem parallel to Sauerland's theory (and Jacobson's where pronouns are assumed to denote the identity function over different domains) does not arise. Consider the crucial example in (149) again.

(149) Every director discussed his film, and every PRODUCER discussed HIS film, too

When the presupposition of *too* is evaluated, essentially (150) must hold. Note in particular that the contrastiveness presupposition is satisfied, as there are relevant properties made salient by the second sentence in (149), and moreover for each director a, it is the case that the proposition that *a discussed a's film* is not a member of $g(C)$. Thus (150) is defined. Furthermore, by (149) the context ensures that the truth conditions in (150) are fulfilled as well. Therefore the presupposition of *too* is fulfilled under the present assumptions, and (149) is correctly predicted to be grammatical.

(150) $\lambda w.\forall x[\text{director}(w)(x) \rightarrow \lambda w'.\text{discuss}(w')(x, x\text{'s film}) \notin \{g(C)\}(x).\text{discuss}(w)(x, x\text{'s film})]$

There is a second problem which only applies to Sauerland's theory. Consider (151) under the bound variable reading for B. We notice that the bound pronoun must be necessarily focused. This means it seems to contrast with the individual *Mary* in A's utterance.

(151) A: John likes Mary's mother

B: Every STUDENT, however, likes HIS mother

If Rooth's traditional theory is assumed together with Sauerland's E-type analysis, the ordinary value for the VP in A's utterance is as in (152), whereas the focus value for the VP in B's utterance is as in (153). It can be easily noticed that (152) is not a member of (153). Thus the focus should not be licensed. The problem is that Sauerland's theory is designed to let bound variables contrast, but it does not apply to cases where a bound variable contrasts with an actual individual.

(152) $[\![\text{VP}_A]\!]^g = \lambda x.\lambda w.\text{like}(w)(x,\text{Mary's mother})$

(153) $[\![\text{VP}_B]\!]^f = \{\lambda x.\lambda w : P(w)(x).\text{like}(w)(x, x's \text{ mother}) \mid P \in D_{\langle e,st\rangle}\}$

The present proposal does, of course, not run into this problem. The reason is that under the present proposal it is actually alternatives with individuals instead of the binding relation that should contrast with the antecedent VP. Thus the apparent contrasting of individuals is straightforwardly captured. In other words, the present proposal does not assign a different status to examples like the present one and the ones with contrasting bound variables.

2.5.3 Jacobson's paycheck pronouns argument

Jacobson (2000) presents the contrast in (154) as an argument against an approach focused bound pronouns making use of bound variables. Whereas the bound pronoun in (154b) can be stressed contrastively, the paycheck pronoun in (154a) cannot be stressed. This is surprising

if paycheck pronouns have an underlying representation that is parallel to the DP in (154b) – that is, if the paycheck pronoun *her* is to be constructed parallel to the DP *his mother*, where the antecedent DP provides the mother-of-function for the paycheck pronoun. The mother-of-function would then apply to an embedded bound variable (cf. Cooper (1979), Engdahl (1986) a.o.).[41]

(154) a. *Every 3d grade boy loves his mother, while every 4th grade boy HATES HER.

b. Every 3d grade boy loves his mother, while every 4th grade boy HATES HIS mother.

(Jacobson 2000:(24),(25))

Jacobson notes that one cannot claim that AvoidF, the principle that strives to minimize focus, is responsible for the obligatory absence of focus on the paycheck pronoun in the grammatical version of (154a). One could imagine that the focus on *her* is blocked because it is possible to stress less material than the whole DP, namely the bound variable embedded in *her*. Since the embedded bound variables contrast, one should stress them as this has the consequence that less material is F-marked than if the whole paycheck pronoun is F-marked. The problem is that this predicts that stress on the paycheck pronoun in (155) should be bad as well, contrary to fact. The generalization seems to be that only if there is a source for the underling function of the paycheck pronoun applying to the bound pronoun other than the material that the paycheck pronoun is to be contrasted with, then F-marking the latter is possible.

(155) Every man$_i$ who loves his$_i$ mother thinks that she$_{f(i)}$ is nice, while every man$_j$ who HATES HIS$_j$ mother thinks that SHE$_{f(j)}$ is a jerk.

(Jacobson 2000:(28))

The problem is that the present approach can make the underlying bound pronouns contrast. I.e., it predicts (155) to be good. But then it is unclear why (154a) is infelicitous. If we make

[41] Alternatively, one could assume an ellipsis analysis for paycheck pronouns. Cf. Karttunen (1969), Partee (1975), Heim (1990), Elbourne (2005) a.o.

the move to claim that the latter is unacceptable because too much material is F-marked, it becomes unclear why this is not so in the former case.[42] This is a genuine and interesting problem. I would nevertheless claim that (154a) is ruled out by AvoidF, i.e., too much material is stressed. This means that (155) is possible because more than the underlying bound pronouns contrast. In particular, the functions supplied in the first and the second conjunct in (155) differ: In the first conjunct it corresponds to the property of being the mother of x and being loved by man x, whereas in the second conjunct it is the property of being the mother of x and being hated by man x. These functions contrast. Therefore AvoidF dictates the stress on the whole paycheck pronoun. No such option is possible for (154a). Here the paycheck pronoun is directly dependent on the DP *his mother* in the first conjunct. The details of such an analysis remain to be worked out, of course.

2.5.4 The problem in a givenness-based theory

In the present subsection I will show that a problem parallel to the one discussed in subsection 2.2.1 obtains when a theory based on givenness is assumed. In other words, the problem is fairly theory-independent. I will illustrate this by using Schwarzschild's 1999 account based on givenness. In this theory focus values do not play a role, i.e., focus is not semantically interpreted as was the case in the theory discussed in the previous section. Schwarzschild's basic idea is that the notion of givenness drives F-marking. In particular, he assumes the condition in (156). That is, there is a condition that checks for each constituent that is not F-marked whether it is given. F-marked constituents are excluded from that condition and need not be given as a consequence.

(156) GIVEN*ness*

If a constituent is not F-marked, it must be GIVEN.

(Schwarzschild 1999:155)

[42] A parallel problem arises in Sauerland's 2008 theory because here it is also the bound pronoun inside the paycheck pronoun that is supposed to contrast with an antecedent pronoun. In Sauerland's case it would be an E-type pronoun with a bound variable in it that the function applies to. Crucially, though, the paycheck pronoun is also complex in his case.

Givenness itself is defined as in (157). The definition requires that for each non-F-marked constituent there be an antecedent constituent in the context. The requirement in (157a) is straightforward. The mechanism of existential type shifting existentially binds open argument positions of the expressions to which it applies. The existentially type shifted version of the antecedent constituent must then entail the existential F-closure of the focus constituent. The existential F-closure of a constituent is the result of replacing each F-mark with a variable of the appropriate type and existentially type shifting the outcome of this process.[43]

(157) *Definition of* GIVEN (final informal version)

An utterance U counts as GIVEN iff it has a salient antecedent A and

a. if U is type e, then A and U corefer;

b. otherwise: modulo ∃-type shifting, A entails the Existential F-closure of U.

(Schwarzschild 1999:151)

Furthermore there is the constraint AvoidF in (158), which is responsible for reducing the number of foci. It is basically an economy condition. It states that if material is given it need not be F-marked – that is, it compares two derivations: one with F-mark and one without F-mark. If the one without F-mark satisfies givenness, it is to be preferred to the one with F-mark.

(158) AVOIDF

F-mark as little as possible, without violating Givenness.

(Schwarzschild 1999:156)

Schwarzschild's theory is designed to account for the fact that (24b) is a felicitous utterance, whereas (159bii) is not, with (159a) being the antecedent sentence. In particular, the constraint AvoidF is incorporated to reduce the number of F-marks. The number of F-marks seems to be exactly what (159bii) suffers from.

[43]Note that any constituent can serve as antecedent for givenness checking, not only constituents having the same logical type as the constituent undergoing checking. This increases the computational load as Gennaro Chierchia (p.c.) reminds me, but it seems to be needed to account for certain examples.

(159) a. Obama praised Bush

b. (i) No, Obama praised CLINTON

(ii) #No, OBAMA praised CLINTON

Let us apply givenness checking now. First consider (159bi). Givenness requires that for each constituent that is not F-marked it must be checked, whether it is given, i.e., whether there is an antecedent that lets it count as given. As (160) shows for each constituent we can find an appropriate antecedent. This means givenness is satisfied. The existentially type shifted versions of the denotation of the constituents considered can serve as antecedent.

(160) *Given constituents*

a. *[Obama praised CLINTON$_F$]:* [Obama praised Bush] entails $\exists x$[Obama praised x]

b. *[praised CLINTON$_F$]:* [Obama praised Bush] entails $\exists x.\exists y$[x praised y]

c. *[praised]:* $\exists x$[x praised Bush] entails $\exists x.\exists y$[x praised y]

d. *[Obama]:* $[\![\text{Obama}]\!]^g = [\![\text{Obama}]\!]^g$

When we consider (159bii), we notice two things. First we need not consider, whether *Obama* is given, because in contrast to (159bi) it is now F-marked. Moreover, givenness is again satisfied for each constituent.

(161) *Given constituents*

a. *[OBAMA praised CLINTON$_F$]:* [Obama praised Bush] entails $\exists x.\exists y$[x praised y]

b. *[praised CLINTON$_F$]:* $\exists x$[x praised Bush] entails $\exists x.\exists y$[x praised y]

c. *[praised]:* $\exists x$[x praised Bush] entails $\exists x.\exists y$[x praised y]

Since givenness is fulfilled by both (159bi) and (159bii) and the former has less F-marks than the latter, (159bi) is more economical and to be preferred by AvoidF. The correct distribution of

focus is thereby accounted for by Schwarzschild's theory.

Let us now consider how Schwarzschild's theory deals with focused bound pronouns. Recall the problematic sentence is as repeated in (162).

(162) Every student cut his (own) arm, and every TEACHER cut HIS arm

When we want to see, whether the whole second conjunct in (162) satisfies givenness, there is only one constituent in the context that could function as antecedent, namely the first conjunct. The existential type shift of the antecedent sentence is equivalent to its semantic value because it denotes a proposition with no open argument slots. The existential F-closure of the second sentence is as given in (163). Since both the restrictor and the bound pronoun are focused, both are F-marked and must be replaced by an existentially bound variable.

(163) $\exists P.\exists y.\forall x[P(x) \rightarrow x \text{ cut } y\text{'s arm}]$

The problem is that (163) is not given, as no appropriate antecedent can be found. Neither the existential F-closure of the antecedent sentence (164a) nor, of course, the existential type shift of the antecedent VP (164b) entail the existential F-closure of the IP.

(164) a. $\forall x[\text{student}(x) \rightarrow x \text{ cut } x\text{'s arm}]$ ¬entails $\exists P.\exists y.\forall x[P(x) \rightarrow x \text{ cut } y\text{'s arm}]$

b. $\exists x[x \text{ cut } x\text{'s arm}]$ ¬entails $\exists P.\exists y.\forall x[P(x) \rightarrow x \text{ cut } y\text{'s arm}]$

What exactly goes wrong? The existential F-closure given in (163) requires that there is some constituent, whose existential type shift says *there is an individual y such that every x of whom some given property holds cut y's arm*. But no such constituent exists. The antecedent sentence – due to the bound pronoun – says that each student cut his own arm. This does not entail the existential F-closure of the second sentence. In particular the existential type shift of the antecedent does not entail that there is an individual whose arm was cut by every individual under consideration. Moreover, the antecedent is also not compatible with the existential F-closure of the focus sentence, given that arms cannot belong to different persons.

There is three potential ways out if one wants to maintain a givenness-based approach, as far as I can see. One would be to claim that the whole second IP in (162) is actually F-marked. This way it would not have to be given. But then the question arises, why the restrictor of the quantifier and the pronoun are F-marked at all. Given that the whole IP is F-marked, there is no need to F-mark any sub-constituents and therefore by AvoidF they must not be F-marked. It seems unlikely that this is a viable solution.

The second possible solution is to make existential F-closure local. This means that when checking givenness for a complex clause, the variables resulting from F-marked constituents need to be bound locally. For the problematic case discussed above, this would entail that existential type shift of the scope of the universal quantifier is forced. But I do not see any principled way to guarantee this. The reason for this skepticism is that applying existential F-closure twice – that is once for the nuclear scope of the quantifier and once globally – would not work. If we apply existential F-closure for the scope first, we get (165):

(165) $\exists y.\exists x[x \text{ cut } y\text{'s arm}]$

The problem is that both argument positions are existentially bound as a result. Recall that existential F-closure also closes open argument positions and not only variables introduced by F-marking. The universal quantifier, however, cannot apply to (165) and there is no way to λ-abstract over a variable anymore in (165) either. So forcing local existential F-closure does not work, it seems.

A third way to circumvent the problem would be to not require givenness checking for the complete IP. What would rather be required in such a setting is that each non-F-marked *sub*-constituent of IP is given. Consider the question-answer pair in (166) in this light. Why is only the F-marking in (166bi) possible and not the one in (166bii)?

(166) a. Who did John hit?

b. (i) He hit HIMSELF

(ii) #He HIT himself

If each non-F-marked subconstituent must be given, then both (166bi) and (166bii) satisfy givenness. The pronouns *he* and *himself* and the predicate *hit* are given in both the former and the latter. When we consider the complex constituents, we see that the VP in (166bi) is given. The existential type shift of the antecedent question is the disjunction of its answers, i.e., $\exists x$*[John hit x]*. This entails the existential F-closure of the VP:

(167) *[hit HIMSELF$_F$]:* $\exists x$[John hit x] entails $\exists x.\exists y$[x hit y]

But the VP in (166bii) counts as given as well:

(168) *[HIT$_F$ himself]:* $\exists x$[John hit x] entails $\exists P$[P(John)]

The issue is that AvoidF cannot decide between the two options, as both use exactly one F-mark. So neither of them is more economical than the other one. That means that optionality between the two options should exist. But this is not the case.

If givenness must be checked for IPs as well, on the other hand, things change. The IP in (166bi) is given:

(169) *[He hit HIMSELF$_F$]:* $\exists x$[John hit x] entails $\exists x$[John hit x]

The IP in (166bii), on the other hand, is not given:[44]

(170) *[He HIT$_F$ himself]:* $\exists x$[John hit x] ¬entails $\exists R$[R(John,John)]

Because of the non-givenness of the IP-constituent itself, (166bii) becomes impossible, and we conclude that IPs must be included in the checking process for givenness. This makes the right predictions for the case just considered, because it does not predict optionality between (166bi)

[44]Note that in Schwarzschild's theory it is the "literal" meaning of some existentially type shifted constituent that counts for givenness checking. So it cannot follow from the antecedent that John bears a relation to himself, even though this would strictly speaking be the case in pretty much every situation. One could think of it in the following way: Givenness checking does not have access to world knowledge and context, other than accessing the context for an antecedent constituent. See the remarks in (Schwarzschild 1999:160 fn.5) on this matter.

and (166bii). Thus the IP-constituent should also be checked for givenness in our problematic case (162) with a quantifier and a variable bound by it. It seems that the givenness-based approach makes a prediction in this respect that is hard to overcome. So the problem is that there is no appropriate antecedent constituent for the existential F-closure of a sentence with a stressed bound pronoun, because the binding relation is not carried over into the existential F-closure.

2.5.5 The nature of the problem and the nature of the solution

In summary, what we see is the following: Both in the focus value approach and in the givenness approach we run into a problem when focus on bound pronouns is considered. In the former case, the problem is that the ordinary semantic value of the sentence is not a member of the focus value of the sentence – that is, of its alternatives. This is because the binding relation of the original sentence is not carried over into the alternatives. In the givenness approach a parallel problem obtains. Existential F-closure of the sentence breaks the binding relation and the theory predicts that no antecedent should be findable, although the example is actually grammatical. It is interesting to note that two theories that look very different on the surface run into the same problem. One might conclude from this that the accounts are actually compatible variants of each other. The question is whether a solution to the problem in terms of one of the two accounts carries over to the other account.

Let us quickly remind ourselves what the solution in terms of focus values advocated in this chapter consisted of. First, the coindexation requirement between $\sim$-operators and antecedents was given up. In effect, now all salient antecedents have to be taken into account. Schwarzschild's theory already does that. So there is no need for change here. Second, and most importantly, the present account relies on local focus evaluation by $\sim$. But crucially the local evaluation of focus has the consequence that the focus value is reset so that the alternatives introduced by focus on the bound pronoun do not figure in sentential focus values.[45] So the real

[45]Note that it is not necessary in the present theory to assume that the lower operator consumes all the foci in its scope. It might be the case that $\sim$-operators are coindexed with the foci they interpret (Wold 1996). At any rate, the operator could still be defined in such a way that the focus that the lower $\sim$-operator is coindexed with does not

question is how local focus evaluation together with some sort of resetting can be incorporated into Schwarzschild's theory. Given that his theory does not make use of ∼-operators to interpret focus, it follows that when the sentential constituent of conjunct two in (171) is evaluated for givenness, it is still (172) that has to be given by the context. But as was shown above this is not the case. The existential closure of conjunct one does not entail (172).

(171) Every student cut his (own) arm, and every TEACHER cut HIS arm

(172) $\exists P.\exists y.\forall x[P(x) \rightarrow x \text{ cut } y\text{'s arm}]$

It appears that if one wants to obtain a parallel account in a givenness-based theory, we must allow for the following: There should be the option that once a focus is evaluated as part of a constituent that is checked for givenness, that focus is not available anymore for further checking.[46] This is what is needed for example (171). In other words, once existential F-closure has applied to the VP as in (173a), the F-mark on the bound pronoun is invisible when the existential F-closure applies at the sentential level (173b). For both (173a) and (173b) we can find suitable antecedents.

(173) a. $\exists$ F-closure($[\![\text{VP}]\!]^g$) = $\exists x.\exists y[\text{cut}(x, y\text{'s arm})]$

b. $\exists$ F-closure($[\![\text{IP}]\!]^g$) = $\forall x[\text{teacher}(x) \rightarrow \text{cut}(x, x\text{'s arm})]$

On the other hand, we do not want that this local evaluation always takes place. I do not want to discuss the whole pattern of overfocusing again at this point. Let us just briefly consider the continuations B and B' of A in (174) once more. By applying existential F-closure obligatorily at the embedded level B would be as infelicitous as B'. The existential F-closure of the VP in B would be as in (175a). There is an antecedent for it. But then the focus on *Sue* becomes inaccessible for further application of existential F-closure. This has the consequence that at the sentential level (175b) should be given. But no antecedent that guarantees this can be found.

contribute to the focus value of the bigger constituent.

[46] As in the proposal in section 2.3 it should also be required that existential F-closure applies at a sufficiently high level – that is, at scope sights.

(174) A: John kissed Mary

B: Yes. And, BILL kissed SUE

B': #Yes. And, BILL kissed Sue

(175) a. $\exists$ F-closure($[\![\text{VP}]\!]^g$) = $\exists x.\exists y[\text{kiss}(x, y)]$

b. $\exists$ F-closure($[\![\text{IP}]\!]^g$) = $\exists x.[\text{kiss}(x,\text{Sue})]$

This behavior is, of course, parallel to the one we are already familiar with from our analysis in terms of focus values and $\sim$-operators. Therefore local application of existential F-closure should be optional, whereas application at the matrix level should be obligatory. In the approach advocated here, this optionality of local application is attributed to a syntactic difference – that is, the present or absence of a local $\sim$-operator. To achieve this in a givenness-based approach we would therefore need an operator in the syntax, as well. More precisely, we need an existential F-closure operator. Without some sort of representational ambiguity we would have to formulate a principle that only applies sometimes. This is not the favored option, it seems. So we need some operator for existential F-closure and that adds a presupposition that the existential closure of some antecedent entails the existential F-closure of the constituent the operator applies to. The problem is, however, that in Schwarzschild's theory we do not have recourse to focus values. So in the informal version of Schwarzschild's proposal is unclear what we could let the operator reset. In the formal version of his analysis, however, there is a way to make things work. Following Kratzer (1991), Schwarzschild assumes that there are two assignments, namely g and the distinguished assignment h. h assigns interpretations to focused constituents. Each F-mark is a designated variable subject to interpretation by h. g is the usual interpretation function. The interpretation rules are given in (176).

(176) If α is F-marked, then:

$[\![[\alpha_{Fn}]]\!]^{g,h}$ = h(Fn)

$[\![[\alpha_{Fn}]]\!]^{g} = [\![[\alpha]]\!]^{g}$

If α has no F-marking, then:

$[\![\alpha]\!]^{g,h} = [\![\alpha]\!]^{g}$ if α is not complex;

if α has components $\beta_1, \ldots \beta_n$, then $[\![\alpha]\!]^{g,h}$ is the result of applying the semantic rule for α to $[\![\beta_1]\!]^{g,h} \ldots [\![\beta_n]\!]^{g,h}$.

(Schwarzschild 1999:152)

With this amendment, we have again two values to our disposal. One can think of the second value, the interpretation with respect to g and h, which is usually referred to as *presup*, as a givenness-value. Now we can define a givenness operator similar to the one in (177). ∃-clo stands for existential closure.[47]

(177) a. $[\![\mathrm{G}]\!]^{g}(\phi) = [\![\phi]\!]^{g}$

if $\exists\psi[\exists - clo([\![\psi]\!]^{g}) \subseteq \exists - clo(\exists x[[\![\phi]\!]^{g,h[x/i]}])]$, otherwise undefined

b. $[\![\mathrm{G}]\!]^{g,h}(\phi) = [\![\phi]\!]^{g}$

Now let us assume that the representation for our crucial example is as in (178). Here the ∼-operators have been replaced by G-operators. The values of the crucial steps in the derivation are then as in (179), where world variables are ignored for simplicity's sake.

(178) [G [$_{\mathrm{IP}}$ [every actor$_{F5}$] [$_{\mathrm{VP}_2}$ G [$_{\mathrm{VP}_1}$ 1[t$_1$ discussed 1$_{F3}$'s film]]]]]

(179) *Assertive component of (178)*

a. (i) $[\![\mathrm{VP}_1]\!]^{g} = \lambda x.\mathrm{discuss}(x, x\text{'s film})$

(ii) $[\![\mathrm{VP}_1]\!]^{g,h} = \lambda x.\mathrm{discuss}(x, h(3)\text{'s film})$

b. (i) $[\![\mathrm{VP}_2]\!]^{g} = \lambda x.\mathrm{discuss}(x, x\text{'s film})$

(ii) $[\![\mathrm{VP}_2]\!]^{g,h} = \lambda x.\mathrm{discuss}(x, x\text{'s film})$

[47] In this respect Wagner's 2006b givenness-operator seems relevant. Note that this operator cannot be straightforwardly amended so that it is applicable to the task at hand, as it does not make reference to the special assignment function h. Also, we will not incorporate the contrastiveness requirement directly into the operator in our formulation:

(i) $[\![\mathrm{G}_R]\!]^{g} = \lambda x.\lambda y.\exists y' \in Alt(y), y' \neq y, s.t.[\![\text{y'x}]\!]^{g}$ is given:$[\![\text{y x}]\!]^{g}$
(Wagner 2006b:299)

c. (i) $[\![\text{IP}]\!]^g = \forall x[\text{actor}(x) \rightarrow \text{discuss}(x, x\text{'s film})]$

(ii) $[\![\text{IP}]\!]^{g,h} = \forall x[(h(5))(x) \rightarrow \text{discuss}(x, x\text{'s film})]$

The G-operators add the presuppositions in (180). Thus, there must first be an existentially closed antecedent value such that it entails that someone discussed someone's film. Second, there must be an existentially closed antecedent value such that it entails that every individual satisfying a particular property discussed his own film. This is also guaranteed.

(180) *Presuppositional component of (178)*

a. $\exists\psi[\exists - clo([\![\psi]\!]^g) \subseteq \exists x.\exists y[\text{discuss}(x, y\text{'s film})]$

b. $\exists\psi[\exists - clo([\![\psi]\!]^g) \subseteq \exists P.\forall x[P(x) \rightarrow \text{discuss}(x, x\text{'s film})]$

We have therefore replicated the results of the present proposal in a givenness-based theory. Three remarks are in order, though. First, it is crucial that we have access to two values for each constituent. Whether we do this with p-sets of presups does not seem to make an essential difference, it seems. Second, operators seem to be necessary, be that a $\sim$- or a G-operator. The reason for this is that thirdly, the focus values or givenness values need to be reset in certain situations. Intuitively, the two theories are now very close, if not equivalent. It must, naturally, be left for further investigation whether the sketch made in the present subsection generalizes to the other data discussed in this chapter.

2.6 Discussion

The present chapter has shown how a theory employing focus values can account for the optional presence of focus on bound pronouns. First it was argued that focus values of bound-variable configurations do not include their own ordinary semantic value as a member. It was shown that this is not a defect, as long as focus interpretation is assumed to be local. Moreover, the coindexing requirement of Rooth's 1992b theory has been given up. In the new theory, the supply of contextual alternatives is entirely pragmatic. It was shown that this is actually a

virtue. By these modifications an account fairly close to Rooth's original treatment of focus can be given for contrastive focus on bound pronouns. In addition, it was argued that a notion of contrastiveness is required. In particular, contrastiveness should be viewed as a requirement that says that the ordinary value of the sister constituent of ~ must not be a member of the contextual alternatives. This derived both the strict contrastiveness phenomenon found with constructions exhibiting focus on bound pronouns, as well as the fact that AvoidF cannot block the F-mark on a bound pronoun if there is local evaluation of focus by ~. Lastly, we have shown that theories treating focus on bound pronouns as constructions necessitating bound E-type pronouns are not needed and are actually problematic given a novel empirical observation.

On a more theoretical note the present chapter shows the following if the argument given is correct: A theory of focus needs some value that can be reset which is different from the ordinary semantic value. For this to work one also needs operators interpreting focus and resetting the second value. It has been shown that this can be also couched in a givenness-based framework, as long as these conditions are observed. Once this is done, it seems that theories making use of focus values become almost equivalent to ones based on givenness, the only difference being that the second value in the latter theory must be a givenness value. This is a potentially interesting result that deserves future investigation.

Chapter 3

Licensing of focus on pronouns and the correct formulation of AvoidF

3.1 Introduction

Focus can serve, among other things, to contrast a constituent with a previous one, thereby – pre-theoretically – making clear which part of an information is old and which is new. The two foci in (1), for instance, signal that the relation of kissing someone is old in the context given, i.e., it is given by the previous context. What is, however, not given is that Bill kissed Sue, i.e. it is new information and thus *Bill* and *Sue* must be focused – that is, they must be focus-marked (F-marked).

(1) John kissed Mary. But BILL kissed SUE

Rooth (1992b) argues that this effect can be captured by employing his notion of focus value.[1] For this approach to work it is essential that focus is interpreted by the semantic component. Recently it has been questioned whether it is really focus that is interpreted. Schwarzschild (1999) – but also Williams (1997), Sauerland (2005), Wagner (2006b) – base their theories

[1] See Rooth (1985) and Kratzer (1991) for two prominent approaches on how to derive the focus value of a given constituent and the discussion below in section 3.4.

on the notion of givenness. These theories share the following: Essentially (1) is treated as an extension of the anaphor phenomenon – that is, non-focused material has a certain semantic trait that lets it get interpreted as anaphoric to some material in the previous discourse. Therefore focus values as a semantic primitive are dispensed with, at least for phenomena such as (1). As we will see, focus in such theories plays the role of identifying material that need not be given, i.e., need not be anaphoric to some antecedent constituent.

We will see that most if not all aspects of Schwarzschild's 1999 approach can be integrated into a theory using focus values as well. As has been shown by Schwarzschild (1999) there must be some condition, called AvoidF in his theory, that compares a structure with focus with the same structure without focus. The one without focus is to be preferred if givenness is satisfied. The empirical problem to be discussed in the present paper has to do with focus on pronouns that could in principle be interpreted as bound or as referential. The gist of the present argument is that Schwarzschild's theory as it stands cannot deal with transderivational comparisons for focus licensing, i.e., situations where two different structures need to be compared. I suggest that the modification of the AvoidF-condition argued for by Truckenbrodt (1995) who considers it an instance of *Maximize Presupposition!* (MP!, cf. Heim (1991)), directly predicts these data and is thus to be preferred to Schwarzschild's formulation. In other words, I will argue for a principle that strives to reduce the size of focus values. AvoidF viewed this way straightforwardly allows us to compare two (independent) structures if they have the same ordinary semantic value, on the one hand, and focus values that are related by the proper subset relation, on the other hand. Therefore the present paper has two objectives: First, it investigates what the correct formulation of AvoidF should be like. Second, on a more conceptual level, it suggests that givenness can be implemented in a theory with focus values without any problems, which was already implicitly assumed in the discussion of the preceding chapter.

The paper is structured as follows: Section 3.2 summarizes the main points of a theory of givenness. In particular, I introduce as much as necessary from Schwarzschild's 1999 theory in order to see why the data from section 3.3 are problematic for it. Section 3.3 introduces the novel empirical observation and discusses the problem caused by it. Section 3.4 implements the

theory of givenness by using Rooth's 1985 focus values and MP!. Schwarzschild's condition of AvoidF is modified accordingly. Section 3.5 returns to Schwarzschild's theory in more detail, and we show that the present theory can capture his insights as well. Section 3.6 concludes the paper.

3.2 Givenness and F-marking

Consider the discourse in (2). Only (2a) is a felicitous continuation of (2), but (2b) is not. Apparently the realization of F-marks is restricted in some way. In other words, a condition is needed that reduces the number of F-marks. One can only focus a constituent if it is absolutely necessary, it seems. What goes wrong in (2b) intuitively is that *Obama* is already mentioned in the antecedent sentence and therefore does not qualify for F-marking. *Obama* is given. I will now briefly review Schwarzschild's 1999 theory, which was the first to my knowledge to propose a condition that reduces the number of F-marks. Moreover his theory is chosen because it can serve as an illustration of a system relying on givenness instead of focus values. I will return to discuss Schwarzschild's theory in more detail in section 3.5 once the empirical puzzle and the present theory have been introduced. Some of the discussion below repeats material found in subsection 2.5.4 of chapter 2.

(2) Obama praised Bush

a. No, Obama praised CLINTON

b. #No, OBAMA praised CLINTON

3.2.1 Schwarzschild's 1999 givenness and focus on pronouns

I will discuss Schwarzschild's theory by considering the data in (3). These are not actually discussed by him. But understanding them will be helpful to grasp the puzzle to be presented in the following section. It should be fairly easy to extrapolate the account for (3) to the problem

in (2) above.[2] Consider (3) and the possible continuations in (3a)-(3b) under the reading where the pronoun *his* refers to Bill. Focus is required on the pronoun on this reading. The question to be addressed is why the pronoun in (3b) must be stressed in the given discourse.

(3) John likes Bill's mother, but ...

a. #BILL likes his mother

b. BILL likes HIS mother

Schwarzschild's basic idea is that the notion of givenness drives F-marking. In particular he assumes the condition in (4). That is, there is a condition that checks for each constituent that is not F-marked whether it is given. F-marked constituents are excluded from that condition and need not be given as a consequence.

(4) GIVEN*ness*

If a constituent is not F-marked, it must be GIVEN.

(Schwarzschild 1999:155)

What it means for a constituent to be given is defined in (5). The definition requires that for each non-F-marked constituent there be an antecedent constituent in the context. The requirement in (5a) is straightforward. The mechanism of existential type shifting existentially binds open argument positions of the expressions to which it applies. The existentially type shifted version of the antecedent constituent must then entail the existential F-closure of the utterance constituent. The existential F-closure of a constituent is the result of replacing each F-mark with a variable of the appropriate type and existentially type shifting the outcome of this process.

[2]In short, (2b) is a case of overfocusing. Both (2a) and (2b) satisfy Schwarzschild's condition of givenness in (4). The economy condition AvoidF (6) therefore applies and dictates that the structure with fewer F-marks is the only one that is licensed.

(5) *Definition of* GIVEN (final informal version)

An utterance U counts as GIVEN iff it has a salient antecedent A and

a. if U is type e, then A and U corefer;

b. otherwise: modulo ∃-type shifting, A entails the Existential F-closure of U.

(Schwarzschild 1999:151)

Furthermore there is the constraint AvoidF in (6) which is responsible for reducing the number of foci. It is basically an economy condition. It states that if material is given, it need not be F-marked – that is, it compares two derivations, one with F-mark and one without F-mark. If the one without F-mark satisfies givenness for all its subconstituents, it is to be preferred to the one with F-mark, even if the latter one satisfies givenness for all of its subconstituents, as well.

(6) AVOIDF

F-mark as little as possible, without violating Givenness.

(Schwarzschild 1999:156)

Let us now return to the discourse in (3) and see how the theory just introduced accounts for the data. But before going into detail, a further remark is in order, which is quite independent from the particular theory of focus licensing chosen to evaluate the data at hand. When we want to see whether the difference in acceptability of the two continuations of (3) is predicted, we have to consider at least two structures that could be assumed for each of the continuations. In particular, it seems that there is a choice between coreference and binding in (3a) and (3b). In the following, I investigate whether the account in terms of givenness discussed above yields the correct results when these two options are considered. I start by considering the coreference structure and then proceed to binding.

Option 1: coreference Let us first consider givenness for (7)– a possible representation of (3a) – where g(1) refers to *Bill*. In other words, (7) shows the structure without F-mark on the pronoun coreferring with the subject.

(7) [BILL$_F$ likes 1's mother]

In all the cases to be considered in this section and the following one, givenness calculation yields the same results for the IP and VP constituents whenever one of the two counts as given. They will therefore not be discussed separately each time. The argument to be given now extends to the other cases, as well. For both the IP and the VP we have to find out whether $\exists x$*[x likes Bill's mother]*, their shared existential F-closure, is entailed by the existentially type shifted version of some antecedent constituent. The reason for this requirement is that the subject is always F-marked in the examples to be considered.[3] Indeed, *John likes Bill's mother* entails this. So both the IP and the VP are given. The property of liking is trivially given as well, and so is the individual *Bill's mother*.

Now consider the same structure with F-mark on the pronoun. Again, g(1) maps onto *Bill*:

(8) [BILL$_F$ likes 1$_F$'s mother]

If there is focus on the pronoun, we need for both the IP and the VP a constituent such that its existentially type shifted meaning entails $\exists x.\exists y$*[x likes y's mother]*. Clearly, *John likes Bill's mother* does entail this. The property of liking is, of course, again given. Moreover the property of liking someone's mother is given because again *John likes Bill's mother* entails it. Since both the structure with focus on the pronoun and the one without focus on it satisfy givenness, AvoidF tells us that the latter must be used. This, however, seems to be the wrong result as we want (3b) to be ruled in and not (3a). Since we have another structure to test – that is, binding – we expect that the binding option must be such that we cannot leave the F-mark off the pronoun. It turns out that this is the case.

Option 2: binding Assume that the LFs for the binding option are as in (9). Moreover, for completeness, assume that g(2) = Jack, although nothing said below will hinge on the interpre-

[3] I will not discuss below whether the F-mark on the subject could be dropped. The answer is that it cannot be dropped. To see this, consider the option under discussion without focus on the subject. In this case it would be required that the proposition *Bill likes Bill's mother* is given. This is clearly not the case, as neither *John likes Bill's mother* nor $\exists$*x[x likes Bill's mother]* entails it. Parallel considerations apply to all examples to be discussed below.

tation of the variable.

(9) a. John likes Bill's mother

b. BILL$_F$ 2[t$_2$ likes 2$_{(F)}$'s mother]

If focus is left off the pronoun, we get multiple violations of givenness. These are listed in (10). In each case it is impossible to find a suitable antecedent such that its existentially type shifted meaning would entail the existential F-closure of the focus constituent.[4]

(10) *Non-given constituents*

a. *[BILL$_F$ 2[t$_2$ likes 2's mother]]:*

John likes Bill's mother ¬entails ∃*x*[*x* likes *x*'s mother]

∃*x*[*x* likes Bill's mother] ¬entails ∃*x*[*x* likes *x*'s mother]

b. *[2[t$_2$ likes 2's mother]]:*

John likes Bill's mother ¬entails ∃*y*[*y* likes *y*'s mother]

∃*x*[*x* likes Bill's mother] ¬entails ∃*y*[*y* likes *y*'s mother]

c. *[2's mother]:*John likes Bill's mother ¬entails ∃*P*[*P*(Jack's mother)]

∃*x*[*x* likes Bill's mother] ¬entails ∃*P*[*P*(Jack's mother)]

∃*P*[*P*(Bill's mother)] ¬entails ∃*P*[*P*(Jack's mother)]

This means that the option without focus on the bound pronoun is not licensed by the theory of givenness. What about the version with focus on the pronoun? In this case givenness is satisfied. In order to see why, just notice that by putting an F-mark on the bound pronoun, we have gotten rid of the requirement that some constituent entails that someone likes his own mother. In other words, it is now for instance required that some constituent entails ∃*x*.∃*y*[*x likes y's mother*]. And *John likes Bill's mother* does entail this. It moreover entails that there is a property holding of someone's mother, as required by the existential F-closure of the non-F-marked constituent

[4]Note that the non-givenness of the constituent *[2's mother]* depends on the particular choice for g(2). But even if g(2) were actually given, the non-givenness of the other two constituents would be problematic enough anyway.

[2$_F$'s mother].

This means that if the binding option is chosen, the obligatory F-marking of the pronoun in the continuation of (3) becomes clear. The only question remaining is why coreference should not be an option. After all proper names are referring expressions, and therefore binding should not be the only possibility. In other words, givenness makes the right predictions if we find a reason why binding must be used instead of coreference. We do not have to look far for an answer. I will suggest that the use of contrastive *but* has this consequence.

3.2.2 *but* requires contrastiveness

Intuitively, the reason why binding is chosen is that the use of contrastive *but* in (3), repeated as (11), requires that the antecedent sentence somehow contrasts with the focus sentence.

(11) John likes Bill's mother, but ...

a. #BILL likes his mother

b. BILL likes HIS mother

The question is how contrastiveness is to be defined. This has been a long-standing question in the literature. For reasons of space we cannot go into a full discussion of this issue. But it has often been assumed that contrastiveness is best addressed by the use of focus values (cf. Büring (2008) a.o.).[5] If one follows this line, one could assume that *but* has the presupposition in (12) introducing a condition of contrastiveness on the denotations of the VPs used (cf. Sæbø (2003) and Umbach (2005) a.o. for related proposals).[6] The focus value $[\![\phi]\!]^f$ for a given constituent ϕ

[5]Note that the definition of contrastiveness used here is not implemented as a presupposition introduced by the $\sim$-operator as argued for in subsection 2.3.4 of chapter 2. This is done to facilitate discussion. It should also be noted that the presupposition associated with but is just the combination of Rooth's 1992b focus principle defended in the previous chapter together with the a contrastiveness requirement. In other words, one could claim that but requires the contrastive $\sim$-operator to be present somewhere in the structure.

[6]Note that Umbach (2005) distinguishes between focus and contrastive topic values in the sense of Büring (1997). In particular, the subject would be marked as a contrastive topic rather than as a focus. This is presumably correct, but what matters for the present discussion is how contrastiveness is defined. For this purpose values are needed that have sets as their denotations. Both focus values and contrastive topic values provide exactly this. There is more to be said about the correct lexical entry for *but*. But for our present purposes the one in (12) should suffice. The presupposition of *but* in (12) is similar to the one for adnominal *however* proposed by Sauerland (2000) with the

is the set of all alternatives to its ordinary denotation $[\![\phi]\!]^g$ of the same type, where the F-mark has been replaced by a variable of the appropriate type. See subsection 3.4.2 below for the definition of focus values and further discussion.[7]

(12) $[\![\text{IP}_1 \text{ but } \text{IP}_2]\!] = [\![\text{IP}_1 \text{ and } \text{IP}_2]\!]$
if $[\![\text{VP}_1]\!] \in [\![\text{VP}_2]\!]^f$ and $[\![\text{VP}_1]\!] \neq [\![\text{VP}_2]\!]$, otherwise undefined.

The antecedent VP of (11) denotes the property *λx.x likes Bill's mother*. This, however, does not contrast with the VP of either (11a) or (11b) once we view the pronouns as being coreferential with the subject. The denotation of the VP in (11) is a member of the focus values of both the VPs in (11a) and (11b). But the denotations are equivalent in both cases. Therefore contrastiveness is not satisfied in this situation. If the binding option is used in the continuations in (11a) and (11b), however, the predicate denotes the property *λx.x likes x's mother*. What is the focus value of the respective VPs? In case the pronoun is not focused, we obtain the singleton set in (13a). The denotation of the antecedent VP is not a member of that set. I.e., contrastiveness is not licensed for this case. If, however, we choose to put an F-mark on the bound pronoun, the set in (13b) obtains.[8] Moreover, the denotation of the antecedent VP is not identical to the binding VP. Thus the presupposition of contrastive *but* is satisfied if there is an F-mark on the bound pronoun. But notice that this is also the configuration favored according to givenness and AvoidF. In other words, the theory of givenness and the requirements imposed by *but* conspire to rule in only the continuation in (11b).

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difference that it does not require the subjects to contrast. The reason for this are cases such as (i). Thanks to an anonymous reviewer for EISS 8 for reminding me of cases such as (i), where the subjects do not contrast.

(i) My children can't stand liver, but they do love chicken

[7]Note that it is not obvious how contrastiveness could be defined without the use of focus values. The notion of givenness does not have anything to say about contrastiveness.

[8]Note that the ordinary value of the VP – that is, the denotation of the binding configuration – is not a member of that set itself.

(13) a. $[\![\text{VP}]\!]^f = \{\lambda x.x \text{ likes } x\text{'s mother}\}$

b. $[\![\text{VP}]\!]^f = \{\lambda x.x \text{ likes } y\text{'s mother} \mid y \in D_e\}$

At first it might seem that there is some redundancy in the system when we restrict ourselves to data such as (11). Both the theory of givenness and the requirements posed by *but* converge on the same solution. In particular, one might think that the correct definition of *but* is all that is needed. This is, however, not correct, as can be shown as follows: When *and* is used instead of *but*, the presuppositions of *but* disappear. As a consequence there should be no pressure to use the binding VP anymore. In particular, both binding and coreference should be options. But because of this focus on the pronoun and no focus should be equally felicitous, as the former is favored by givenness for binding, whereas the latter is favored for the coreference VP. This is confirmed by (14).

(14) John likes Bill's mother, and ...

a. BILL_F likes HIS_F mother

b. BILL_F likes his mother

We observe that all of a sudden the focusing of the pronoun becomes optional. That this optionality is the consequence of having two independent structures at disposal – that is, coreference and binding – is shown by (15). Here binding is not an option and the possibility of leaving the F-mark off *John* is not there. This is so because the VP in (15b) violates givenness. The property of liking John's mother is not given. But the property of liking someone's mother is, which is why F-marking *John* produces a felicitous outcome. From this we conclude two things: First, our conjecture that (14a) is the consequence of binding and (14b) the one of coreference finds independent support. The optionality of focusing only appears in situations where two structural analyses are possible.[9] Moreover, the theory of givenness together with AvoidF applies to the two possible structures independently. Second, if givenness is at stake in (14) and (15), it should also apply in (11). In other words, in addition to the correct definition of contrastive *but*

[9] Apart from the cases discussed in paper 2, of course.

the theory of givenness is needed.

(15) John likes Bill's mother, and ...

a. BILL$_F$ likes JOHN$_F$'s mother

b. #BILL$_F$ likes John's mother

This line of argumentation is further supported by (16). In case the antecedent VP is made up of a conjunction where one conjunct denotes the property of liking one's own mother and the other the one of liking Bill's mother, both the binding and the coreference option are ruled out. First, assume a further modification of the definition of *but*: All that is required by it is that one of the conjuncts in the antecedent VP contrasts with the one in the utterance VP. When we consider the binding option, there is an antecedent that contrasts with it. In particular, the property of liking Bill's mother contrasts with liking one's own mother. AvoidF, however, dictates that focus on the bound pronoun cannot be used because the property of liking one's own mother counts as given. The binding VP without focus on the bound pronoun, on the other hand, does not satisfy the definedness condition imposed by *but*. The focus value of this VP is just the singleton set in (13a). There is no antecedent denotation that is both a member of this set and is not identical to the ordinary value of the VP. What about the coreference option? This option is not licensed because there is no antecedent denotation that satisfies contrastiveness. In particular, the focus value of the coreference VP with an F-mark on the free pronoun is as in (13b). The only antecedent denotation that is a member of it is the property of liking Bill's mother. But it is also identical to the ordinary value of the VP. Contrastiveness is not fulfilled. The same applies to the coreference option without F-mark on the free pronoun. If we just had the requirements of *but* at our disposal, the unacceptability of (16a) and (16b) could not be accounted for.

(16) John likes his own mother and Bill's mother, but ...

a. #BILL$_F$ likes HIS$_F$ mother

b. #BILL$_F$ likes his mother

So far a theory of givenness and in particular Schwarzschild's 1999 approach accompanied by a few assumptions about contrastiveness being introduced by *but* makes the right predictions. Let us now turn to another set of data which complicates the picture. In particular, the assumptions made about *but* will generate problems.

3.3 Contrastive focus on pronouns

This section presents a problem for theories of givenness, in particular the one formulated by Schwarzschild (1999) and discussed in the preceding section. Data with focus on pronouns suggest that a revision is necessary. The data are minimally different from the ones discussed in section 3.2. We will see that a minimal change – essentially the addition of negation – affects the predictions of the theory dramatically. On the basis of these data an argument can be made that the set of competitors considered by AvoidF needs to be enlarged. In the discussion below, I will not show for all the constituents whether they are given if it is obvious that they are. Rather, I will pick the ones where it is not immediately clear whether givenness holds and discuss them in detail.

3.3.1 Adding negation

Consider (17), under the reading where the pronoun refers to Bill. When there is negation involved, focus on the pronoun is not allowed (17a)-(17b). The negation is necessarily focused. This suggests that focus on the negation satisfies the contrastiveness requirement introduced by contrastive *but*. Moreover the impossibility of focusing the pronoun in (17b) reminds us of data like (2) that were used as an argument for the postulation of a condition that minimizes the number of foci as AvoidF does in Schwarzschild's 1999 theory. This leads us to expect that an account in terms of givenness should be possible. In other words, the treatment of (2) should

extend to the case in (17).[10] [11]

(17) John likes Bill's mother, but ...

a. BILL DOESN'T like his mother

b. #BILL DOESN'T like HIS mother

We will see, however, that (17) behaves differently from the data introduced in the preceding section and that a straightforward explanation using givenness and AvoidF is not available. Let us first see why the theory as sketched so far fails. We look, again, at the coreference and the binding options separately.

Option 1: coreference Again, g(1) refers to Bill. If the pronoun is referential and there is no F-mark on the pronoun (18), all the relevant constituents are given. The DP *[1's mother]* and the pronoun itself are trivially given. In the following t is a variable over functions of type $\langle t, t\rangle$:

(18) [BILL$_F$ DOESN'T$_F$ like 1's mother]

(19) *Given constituents*

a. *[BILL$_F$ DOESN'T$_F$ like 1's mother]:*

[John likes Bill's mother] entails $\exists t.\exists x[t(x$ likes Bill's mother)]

---

[10] Stress on the pronoun *his* can be ameliorated under particular circumstances, namely if the stress on *Bill* is dropped – that is, if (i) is the sentence in question. But in this situation it seems that the sentence is not read as a continuation of *John likes Bill's mother* anymore. Rather an antecedent of the form *Bill likes Mary's mother* is accommodated.

(i) Bill DOESN'T like HIS mother

[11] Hazel Pearson (p.c.) notes that stress on the pronoun can be ameliorated if the stress on *Bill* is removed, as in (i). It is not completely clear to me why this is possible. It must be noted, however, that the first conjunct in (i) cannot serve as the antecedent for the second one in any case. The reason is that neither the proposition that Bill likes his own mother or that Bill doesn't like his own mother is given. Therefore, I assume that to the extent that (i) is possible, another antecedent must be accommodated.

(i) John likes Bill's mother, but Bill DOESN'T like HIS mother

b. *[DOESN'T_F like 1's mother]:*

$\exists x$[x likes Bill's mother] entails $\exists t.\exists x$[t(x likes Bill's mother)]

If there is an F-mark on the pronoun (20), givenness will be satisfied because having more foci makes givenness-licensing easier. It is sufficient to notice that in all existential F-closures where *Bill* is used in (19), *Bill* is replaced by an existentially bound variable. But $\exists t.\exists x.\exists y$[$t$($x$ likes y's mother)] is, of course, given in that situation.

(20) [BILL$_F$ DOESN'T$_F$ like 1$_F$'s mother]

By AvoidF the F-mark on the pronoun is not licensed in this situation. This means that under the coreference option (17a) should be preferred to (17b), i.e., the pattern in (17) is explained. In that respect the new data differ from the data discussed in the previous section. As we have seen coreference is not an option there due to the contrastiveness requirement of *but*. Would contrastiveness be satisfied by (18)? The focus value for the VP in (18) is as in (21). The denotation of the VP in the antecedent is the property of liking Bill's mother. This can be taken to be a member of (21) if one assumes that the identity-function serves as an alternative to negation. In this case, the denotation of the antecedent VP would contrast with the one of the VP in (18). In other words, the felicitousness of (17a) and the infelicity of (17b) are predicted by the coreference option.

(21) $[\![\text{VP}_{(18)}]\!]^f = \{\lambda x.t(x \text{ likes Bill's mother}) \mid t \in D_{\langle t,t\rangle}\}$

We still have to consider the binding option. If the contrast in (17) is to be explained, this option should not rule in (17b) either.

Option 2: binding For the binding option, assume the LFs in (22), where g(2) = Jack, again. Note that negation is in the VP and the subject is QRed above it. This is necessary because we want the focus on negation to be licensed in order to let the VP contrast with the antecedent VP.

(22) a. John likes Bill's mother

b. BILL_F 2[NOT_F t_2 likes $2_{(F)}$ mother]

If there is no F-mark on the bound pronoun, no violation of givenness obtains except for the constituent *[2's mother]*, which is not given. Similar remarks as in footnote 4 apply with respect to its givenness. It is left out below therefore.

(23) *Given constituents*

a. *[BILL_F 2[NOT_F t_2 likes 2's mother]]:*

[John likes Bill's mother] entails $\exists t.\exists x[t(x$ likes x's mother)]

$\exists x[x$ likes Bill's mother] entails $\exists t.\exists x[t(x$ likes x's mother)]

b. *[2[NOT_F t_2 likes 2's mother]]:*

[John likes Bill's mother] entails $\exists t.\exists x[t(x$ likes x's mother)]

$\exists x[x$ likes Bill's mother] entails $\exists t.\exists x[t(x$ likes x's mother)]

As with the data in section 3.2, if we get rid of the offending bound pronoun in the existential F-closures considered by focusing it, givenness is again satisfied. In particular, the existential F-closure of both the IP and the VP is given because *John likes Bill's mother* entails $\exists t.\exists x.\exists y[t(x$ *likes y's mother)]*. By AvoidF, however, the bound pronoun should not be focused, as less F-marks are preferred. The remaining question is whether this option satisfies the requirements imposed by contrastive *but*. The focus value of the VP in (22b) without F-mark on the bound pronoun is as in (24). The property denoted by the antecedent VP – that is, the property of liking Bill's mother – is not a member of (24). I.e., the contrastiveness requirement is not satisfied if we choose to leave the F-mark off the bound pronoun.

(24) $[\![\text{VP}_{(22b)}]\!]^f = \{\lambda x.t(x \text{ likes } x\text{'s mother}) \mid y \in D_e, t \in D_{\langle t,t\rangle}\}$

When we consider the option for the VP with F-mark, the focus value in (25) obtains. This time the denotation of the antecedent VP is a member of (25), provided again that the identity

function is an alternative to negation. Moreover, the antecedent denotation is not identical to the ordinary value of the VP in (22b). Therefore the contrastiveness requirement is satisfied by the VP with an F-mark on the bound pronoun.

(25) $[\![\text{VP}_{(22b)}]\!]^f = \{\lambda x.t(x \text{ likes } y\text{'s mother}) \mid y \in D_e, t \in D_{\langle t,t\rangle}\}$

But this means that the binding option would actually dictate the use of (17b) over (17a), because without focus on the pronoun contrastiveness is not satisfied. Note that AvoidF would not block the F-mark on the bound pronoun. It is an economy condition. As such it only applies if no other condition is violated. In the present case the contrastiveness condition is violated. Therefore the option satisfying both givenness and contrastiveness must be chosen. This, however, is the one with an F-mark on the bound pronoun. This moreover suggests that the coreference option is used for the continuation in (17). As we will see momentarily, it is not clear, however, why the binding option and therefore focus on the pronoun is not licensed. From what we have seen so far, we expect optionality of focus on the pronoun.

3.3.2 The puzzle

To summarize: Remember that for the data in section 3.2 we said that the contrastiveness requirement of *but* requires the use of the binding option. Binding in turn required the use of an F-mark on the pronoun by givenness. This explained the pattern in (3) repeated as (26). In the data of the present section, (17) repeated as (27), on the other hand, the F-mark on the pronoun is prohibited. Given what we just saw, this means that the coreference option is chosen in this case. This explains the pattern.

(26) John likes Bill's mother, but ...

a. #BILL likes his mother

b. BILL likes HIS mother

(27) John likes Bill's mother, but ...

a. BILL DOESN'T like his mother

b. #BILL DOESN'T like HIS mother

The problem with this account is that one would expect (27b) to be an option under the reasoning from above. In particular, the binding option should rule in (27b). We have seen that in this case the bound pronoun must be F-marked. Otherwise a violation of the contrastiveness condition would incur. Only if the pronoun is stressed, the contrastiveness requirement is also fulfilled in that situation. Again, AvoidF does not apply in this situation because only the less economical option with an F-mark satisfies both givenness and contrastiveness. Thus nothing blocks (27b) from surfacing.

Intuitively speaking the problem in (27b) seems to be that there are too many foci. This means that AvoidF should rule it out. Recall that it is the coreference structure without F-mark on the pronoun in (28a) that rules out the coreference version with F-mark on the pronoun in (28b) because givenness checking does not lead to any violations of givenness in either of them.

(28) a. BILL_F NOT_F likes 3's mother

b. BILL_F NOT_F likes 3_F's mother

But there is no way that (28a) can rule out the binding structure in (29), which has focus on the pronoun. This is because givenness compares identical structures that only differ in the presence or absence of an F-mark. But (29) differs from (28a) in having a QRed subject and a binder co-indexed with the pronominal variable.[12] Moreover binding without F-mark cannot rule (29) out either because it is not even licensed by contrastiveness.

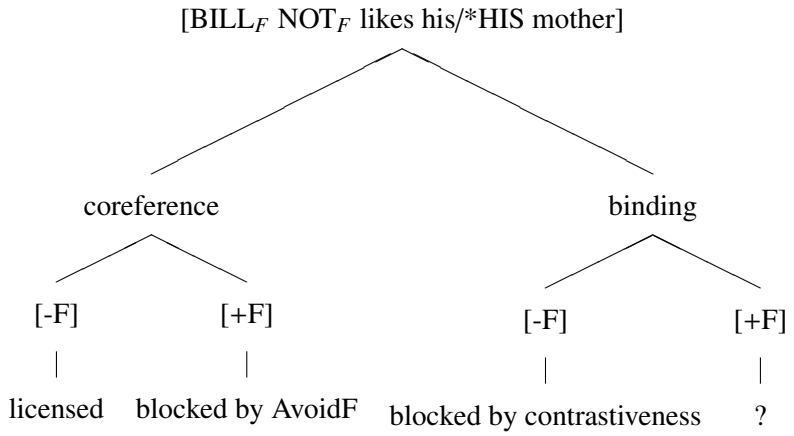
(29) BILL_F 2[NOT_F t_2 likes 2_F's mother]

[12]Note that one cannot claim that the binding option simply does not exist because binding is needed to explain the data from section 3.2. Otherwise (26a) would be preferred over (26b). Moreover, if anything, one would expect following Reinhart (1983), Heim (1998) a.o. that the binding option is preferred if both binding and coreference are possible. In any case, if one is to defend that the coreference option is the one that is used in (27a), it must be claimed that the preference of binding over coreference is overridden by an additional requirement, the requirement being givenness. Presumably this is no problem, as the preference of binding over coreference has the status of a rider that can be voided if need be, anyway.

The nature of the problem can therefore be characterized as follows:

(30) *Nature of the problem*

Coreference$_{[-F]}$ cannot block binding$_{[+F]}$ by AvoidF because coreference and binding employ different structures:



Intuitively, in order to achieve the correct distribution of F-marking, we want to find a way to let (28a) not only block (28b), but also (29). That means that the set of competitors considered by our theory must be expanded. In the following section I propose a solution that does exactly this in order to deal with this transderivational dilemma.

But before going on we have to be sure that the effect we are observing in (27) is not of a more general sort; that is, is it ever possible or necessary to stress part of the VP when negation and contrastive *but* are involved? Consider (31) and its possible continuations. It seems that we find a preference for F-marking *John* in this situation. It is clear why *John* in (31a) is F-marked: The property of liking John's mother is not given in the present discourse. (31b) might not be completely out as a continuation to (31), but it is definitely disfavored compared to (31a). This is as expected because the property of liking John's mother is not given in the discourse.

(31) John likes Bill's mother, but . . .

a. BILL DOESN'T like JOHN's mother

b. ?BILL DOESN'T like John's mother

The reason why the judgements regarding (31b) are a little delicate, I suspect, is as follows: In a situation where we are talking about the individuals John and Bill and their respective mothers, the utterance of (31) might give rise to an expectation that each one likes the other's mother. In other words, (31) could give rise to the additional implicated antecedent *Bill likes John's mother*. In this sense, the property of liking John's mother could count as given and *John* would not have to be F-marked. Note that such an additional antecedent might also be available for (26) and (27). But in neither case do the continuations make use of that antecedent. Therefore, only the overt linguistic antecedent material matters for givenness calculation. At any rate, (31) shows that F-marking part of the VP is possible when negation and contrastive *but* are used. Therefore the puzzle discussed above cannot be reduced to independent factors.[13]

3.4 Focus values redux

In the present section I implement givenness by employing focus values and I argue for a modified version of AvoidF. AvoidF is replaced by MP! that essentially reduces the size of focus values.

[13] Irene Heim (p.c.) notes that in the discourse in (32) focusing *patricide* is infelicitous. First, we have to see whether givenness is satisfied for the VPs in (32a) and (32b), respectively. The existential F-closure of the former is $\exists x[t(x \textit{ commits patricide})]$. The property denoted by the antecedent VP is *killing Bill's father*. Its existential closure, however, does not entail the existential F-closure. Moreover, the constituent *[patricide]* is crucially not given, either. The existential F-closure for the VP in (32b), on the other hand, is $\exists x.\exists y[t(x \textit{ commits } y)]$. It can be argued that this constituent is given because the property denoted by the antecedent VP – that is, *killing Bill's father* – entails committing murder. But then it is unclear why (32b) is infelicitous, whereas (32a) is felicitous. The only way to address the infelicity of (32b) is to assume that *commit patricide* can either have a bound variable or a coreference structure. In the latter case what needs to be given is that someone killed Bill's father. The discourse guarantees this. (32b), on the other hand, would have to have the binding configuration as underlying structure. Only focusing the underlying bound variable, which surfaces as focus on *patricide*, obeys givenness. If this is assumed, the pattern in (32) becomes parallel to the one in (27) in the text, and the solution to the latter should extend to the former.

(32) John killed Bill's father, but . . .

a. BILL DIDN'T commit patricide
b. #BILL DIDN'T commit PATRICIDE

3.4.1 Informal presentation of the idea

Recall the nature of the puzzle from subsection 3.3.2: We want a structure without F-mark to block a *different* structure that has an F-mark. But this is impossible with a condition that compares parallel structures that only differ in F-marking. A natural way to circumvent this problem is to try to capitalize on semantic values because in principle two different structures can yield the same semantic value. This is especially true for structures that allow both coreference and binding. Consider (33). It does not matter for the meaning whether the underlying structure is (34ai) or (34aii), as long as g(3) maps onto John. If the latter holds, the semantic values are identical (34b).

(33) John finished his dissertation

(34) a. (i) John finished 3's dissertation

(ii) John 2[t_2 finished 2's dissertation]

b. [[(34ai)]] = [[(34aii)]] = John finished John's dissertation

Assume we have on the one hand focus values in our system and a condition on focus licensing more or less similar to Rooth's 1992b one, i.e., there must be an antecedent whose ordinary semantic value is a subset/member of the focus value of the focus constituent. Given the discussion from subsection 3.3.2, on the other hand, we also need something that lets the coreference structure without focus block the binding option with focus. So assume moreover that there is a condition that says: The smaller the size of a focus value, the better. In particular, (35a) and (35b) have the same ordinary semantic value if g(3) maps onto Bill. So in principle both could be used as continuations in the example discussed in the previous section. But I will show that the focus value of a coreference structure without focus on the pronoun has a smaller focus value than both the coreference structure with focus and the binding structure with focus. The condition that reduces the size of focus values therefore prefers the former to the latter two.

(35) a. BILL_F NOT_F likes 3_F's mother

b. BILL_F 2[NOT_F likes 2_F's mother]

The binding structure without focus, however, is shown to not conform to the first condition – that is, Rooth's focus condition. In other words, there is no appropriate antecedent for such a structure. In addition it also does not satisfy the contrastiveness requirement, as we already know. Let us now turn to a more detailed outline of this idea.

3.4.2 The system

I will now introduce the assumptions made in order to account for the data discussed in the present paper. Remember that we are assuming Rooth's 1985 theory of focus, where an F-mark on a constituent makes alternative meanings of the same type as the constituent available. This is formalized by having two semantic values in the system, an ordinary semantic value and a focus value. The latter corresponds to the set of alternative meanings for the ordinary meaning an F-marked constituent (cf. the discussion in subsection 2.2.1 in chapter 2). In other words F-marks introduce alternatives. Thus we have the following interpretive rules:

(36) *Semantic values*

a. (i) $[\![\text{A}_{F,\sigma}]\!] = A$

(ii) $[\![\text{A}_{F,\sigma}]\!]^f = D_\sigma$

b. (i) $[\![\text{A}_\sigma]\!] = A$

(ii) $[\![\text{A}_\sigma]\!]^f = \{[\![\text{A}_\sigma]\!]\}$

Following Hamblin (1973) and Rooth (1985) the rule of functional application can be defined as in (37) when dealing with sets, as is necessary in the case of focus values. I assume that the rule in (37) is only necessary for the computation of focus values. In other words, ordinary values do not correspond to sets.

(37) *Functional application*

Given branching node A with daughters B of type $\langle\sigma\tau\rangle$ and C of type $\langle\sigma\rangle$, $[\![\text{A}]\!]^f = \{f(x) \in D_\tau : f \in [\![\text{B}]\!]^f \text{ and } x \in [\![\text{C}]\!]^f\}$.

Moreover, the theory makes use of the ∼-operator which interprets foci. The semantic contribution of the operator is given in (38), repeated from (11) in chapter 2. It adds the presupposition that the contextually relevant alternatives $g(C)$ form a subset of the focus value of the sister constituent of the ∼-operator, ϕ. In addition it resets the focus value to the ordinary value of its sister (cf. Rooth (1992b) and Beck (2006)). In short, (contrastive) focus is licensed if the ordinary value of the antecedent is a member/subset of the focus value considered – that is, of the focus value of ϕ. We refer to this as the *focus principle*. Furthermore, I assume for concreteness that each sentential node has ∼ adjoined to it. This has the effect that focus must be necessarily evaluated at the sentential level. Further ∼-operators are optional.[14]

(38) a. $[\![\sim]\!]^g(g(C)_{\langle\tau,t\rangle})([\![\phi]\!]^g{}_\tau) = [\![\phi]\!]^g$

if $g(C) \subseteq [\![\phi]\!]^f$, otherwise undefined

b. $[\![\sim]\!]^f(g(C)_{\langle\tau,t\rangle})([\![\phi]\!]^f{}_{\langle\tau,t\rangle}) = \{[\![\phi]\!]^g\}$

I will now introduce a new way of looking at AvoidF. In particular following Truckenbrodt (1995), I argue that it should be replaced by MP!. Truckenbrodt refers to this as *Maximize background*. MP! as a principle is introduced by Heim (1991). MP! is a condition which says that if there are alternatives ϕ and ψ conveying the same truth conditional information such that both satisfy the conditions imposed by the context, the alternative with the strongest requirement on the context has to be chosen. Heim motivates this condition by observing a competition in the use of the indefinite and definite articles following Hawkins (1981). The indefinite article cannot be used to modify a predicate in situations where it is already known that the predicate is only satisfied by one individual. It is assumed that the definite and the indefinite articles form

[14]Note that (38) does not incorporate the changes for the ∼-operator argued for in the preceding paper. The reason is that they are not directly relevant here. In order to keep the discussion simple, I will therefore stick with the traditional formulation of the operator.

lexical alternatives for purposes of MP!. Since an analysis of the definite article is assumed where the uniqueness of the modified predicate is presupposed, the definite article must be used in such situations. Consider (39). A car usually has only one engine. Both the indefinite article in (39a) and the definite article in (39b) could be used to convey the same information. But the definite article places a stronger requirement on the context due to the added uniqueness presupposition. By MP! it is preferred.

(39) a. #An engine of my car broke

b. The engine of my car broke

We can use MP! to do the job of AvoidF.[15] In particular, one can think of utterances as being split into focused and backgrounded material (cf. Stechow (1990) and Krifka (1992) a.o.). In Rooth's theory it is natural to extend this view to parts of utterances – that is, to focus domains (FD). Assume that FD is defined as in (40). MP! can be defined as in (41). ϕ and ψ in the discussion below will correspond to different choices for the values of FD.

(40) *Focus Domain*

A focus domain corresponds to the scope of a $\sim$-operator.

(41) *Maximize Presupposition*

Given alternatives ϕ and ψ such that ϕ and ψ convey the same truth-conditional information, choose the one with the strongest requirement on the context possible.

Let us now turn to the application of the theory to the puzzling data discussed in the previous section.

[15] In what follows I will assume that MP! only regulates the position of F-marks inside a focus domain. In Truckenbrodt's 1995 theory it is also the establishment of the focus domain itself that is regulated by MP!, i.e., the attachment site of $\sim$ is subject to MP! as well. This is presumably the correct way to think about it. But since we are assuming that the sentential level has an obligatory $\sim$ adjoined anyway, and since the data discussed in this section do not make it necessary to establish smaller focus domains, I will proceed as if MP! had nothing to say about the attachment site of $\sim$.

3.4.3 Explanation of data

Let me first repeat the crucial data once more:

(42) John likes Bill's mother, but ...

a. BILL DOESN'T like his mother

b. #BILL DOESN'T like HIS mother

I will now show that the system introduced in the previous subsection accounts for the obligatory absence of focus on the pronoun in (42). The LFs we have to consider are the ones given in (43), i.e., both the coreference and the binding option with and without focus on the pronoun, respectively. The value of g(2) is immaterial for the present discussion since we are only considering the semantic values of the whole IPs. In each case the ∼-operator is coindexed with the antecedent sentence in (42).

(43) a. (i) $[_{CP} \sim C\ [_{IP}\ BILL_F\ NOT_F$ likes his mother]]

(ii) $[_{CP} \sim C\ [_{IP}\ BILL_F\ NOT_F$ likes his_F mother]]

b. (i) $[_{CP} \sim C\ [_{IP}\ BILL_F\ 2\ [_{VP}\ NOT_F\ t_2$ likes 2's mother]]]

(ii) $[_{CP} \sim C\ [_{IP}\ BILL_F\ 2\ [_{VP}\ NOT_F\ t_2$ likes 2_F's mother]]]

First, note that all of the options have the same ordinary semantic value. This means that MP! as defined can apply. MP! compares alternatives with the same truth-conditional contribution and chooses the one with the strongest requirement on the context. So the question is which one of the options in (43) makes the strongest requirement:

(44) $[\![(43)]\!] = \lambda w.\neg$Bill likes Bill's mother in w

The focus value for the IP in the coreference option without F-mark on the pronoun – that is, for (43ai) – is given in (45). As there is no F-mark on the pronoun, no alternatives are introduced for the individual denoted by the pronoun. The focus value is the set of propositions of the

form *x likes Bill's mother*, *x* an individual, with a function of type $\langle st, st \rangle$ applied to it. Notice moreover that I am treating the identity map (ID) as an alternative to negation, again.

(45) $[\![\text{IP}_{(43ai)}]\!]^f = \{t(\lambda w.x \text{ likes Bill's mother in } w) \mid x \in D_e, t \in D_{\langle st,st \rangle}\}$

Consider now the focus values of the IPs of the coreference option and the binding option – where both exhibit an F-mark on the pronoun – (43aii) and (43bii) respectively. The two focus values are identical. Since the F-mark on the pronoun introduces alternatives for the pronoun, the difference between binding and coreference becomes superfluous. The focus value is now the set of propositions of the form *x liked y's mother* with a function of type $\langle st, st \rangle$ applied to it.

(46) $[\![\text{IP}_{(43aii)}]\!]^f = [\![\text{IP}_{(43bii)}]\!]^f = \{t(\lambda w.x \text{ likes } y\text{'s mother in } w) \mid x, y \in D_e, t \in D_{\langle st,st \rangle}\}$

Now we have to check which ones of the focus values considered so far satisfy the focus principle. I.e., it has to be seen whether the ordinary value of the antecedent sentence is a member of the focus values or not. The ordinary value of the relevant antecedent is obviously as follows:

(47) $[\![\text{IP}_{antecedent}]\!] = \lambda w.\text{John likes Bill's mother in } w$

It turns out that the focus principle would be satisfied by all of the focus values above, i.e., (47) is a member of all of the focus values above. Given that all three options would in principle be possible focus values given the antecedent, and given that we have seen that all structures under consideration share their denotation, MP! will determine which focus value is to be chosen. It turns out that the focus value of the coreference option without F-mark is a proper subset of both focus values with an F-mark, as stated in (48). Thus the former option is strictly stronger than the latter two, which means that it places a stronger requirement on the context. Thereby it blocks both options with a focus on the pronoun, i.e., the focus values of the structures with F-mark on the pronoun are simply too large, and thus they are uneconomical.

(48) $\{t(\lambda w.x \text{ likes Bill's mother in } w) \mid x \in D_e, t \in D_{\langle st,st\rangle}\} \subset \{t(\lambda w.x \text{ likes } y\text{'s mother in } w) \mid x, y \in D_e, t \in D_{\langle st,st\rangle}\}$

Remember that we are assuming that in addition to the obligatory ∼-operator attached to the sentential level, further embedded ∼-operators are optional and sometimes necessary (cf. Rooth (1992b) and the discussion in Mayr (to appeara)). The question is whether these additional LFs would not actually license the infelicitous (42b). This means that at least the following structures have to be considered possible LFs.[16]

(49) a. (i) $[_{\text{CP}} \sim \text{C} [_{\text{IP}} \text{BILL}_F [\sim \text{C} [_{\text{VP}} 2[\text{NOT}_F\ t_2 \text{ likes his mother}]]]]]$

(ii) $[_{\text{CP}} \sim \text{C} [_{\text{IP}} \text{BILL}_F [\sim \text{C} [_{\text{VP}} 2[\text{NOT}_F \text{ likes his}_F \text{ mother}]]]]]$

b. (i) $[_{\text{CP}} \sim \text{C} [_{\text{IP}} \text{BILL}_F [\sim \text{C} [_{\text{VP}} 2[\text{NOT}_F\ t_2 \text{ likes 2's mother}]]]]]$

(ii) $[_{\text{CP}} \sim \text{C} [_{\text{IP}} \text{BILL}_F\ 2 [\sim \text{C} [_{\text{VP}} 2[\text{NOT}_F\ t_2 \text{ likes } 2_F\text{'s mother}]]]]]$

There are no significant differences to the cases considered above, however. Again, the focus value of the VP in (49ai) – that is, (50a) – is the strongest requirement that can be placed on the context. The ordinary value of the antecedent VP is a member of that value. Moreover, (50a) is strictly stronger than the focus value for both options with an F-mark on the pronoun given in (50b). Thus MP! prefers the former focus value. (49bi) is again ruled out as structure because there is no binding relation in the antecedent VP. Thus the focus principle could never be satisfied. This means our theory makes the correct predictions concerning the data we set out to derive.

(50) a. $[\![\text{VP}_{(49\text{ai})}]\!]^f = \{\lambda x.\lambda w.t(x \text{ likes Bill's mother in } w) \mid t \in D_{\langle st,st\rangle}\}$

b. $[\![\text{VP}_{(49\text{aii})}]\!]^f = [\![\text{VP}_{(49\text{bii})}]\!]^f = \{\lambda x.\lambda w.t(x \text{ likes } y\text{'s mother in } w) \mid y \in D_e, t \in D_{\langle st,st\rangle}\}$

[16]Note that the attachment sites of ∼ might also be regulated by MP! as discussed in footnote 15 above. Let us nevertheless see what the outcome is if this option is ignored, i.e., if we proceed as if the positioning of ∼ were not conditioned by MP!.

What remains to be shown is that the binding structure without focus on the pronoun (43bi) is ruled out by our system. First remember that this option is already blocked by the fact that the contrastiveness requirement is not satisfied by the VP used. This was the very reason why the puzzle in the preceding section arose. But in addition – in contrast to Schwarzschild's 1999 system – there is another reason why this option cannot surface. Consider the focus value for the corresponding IP. It can be seen that the ordinary semantic value of the antecedent IP (47) is not a member of (51). Therefore, in addition to the violation of contrastiveness, the focus principle is not satisfied by (43bi) either.

(51) a. $[\![\text{IP}_{(43\text{bi})}]\!]^f = \{t(\lambda w.x \text{ likes } x\text{'s mother in } w) \mid x \in D_e, t \in D_{\langle st,st\rangle}\}$

Let us also briefly reconsider the data from subsection 3.2.1 above, which were used to introduce Schwarzschild's system. First recall the data:

(52) John likes Bill's mother, but ...

a. #BILL$_F$ likes his mother

b. BILL$_F$ likes HIS$_F$ mother

From our considerations regarding the contrastiveness requirement of contrastive *but* we already know that coreference as a whole is ruled out in this situation. Coreference, both with focus and without focus on the pronoun, is not available because the VPs do not contrast. Therefore we only have to consider the binding options in (53).

(53) a. [$_{\text{CP}}$ ~ C [$_{\text{IP}}$ Bill$_F$ 1 [$_{\text{VP}}$ t$_1$ likes 1's mother]]]

b. [$_{\text{CP}}$ ~ C [$_{\text{IP}}$ Bill$_F$ 1 [$_{\text{VP}}$ t$_1$ likes 1$_F$'s mother]]]

The ordinary semantic value of the antecedent is not a subset of the focus value in (54a) – that is, of the focus value of the binding IP without F-mark on the pronoun. (53a) therefore does not satisfy the focus principle and is blocked. The antecedent value is, however, a subset of the focus value for (53b), which is given in (54b). The focus principle is satisfied. Moreover remember

that although the coreference option without F-mark on the pronoun would also satisfy FR – because its focus value would be $\{\lambda w.x$ *likes Bill's mother in* $w \mid x \in D_e\}$ and the denotation of the antecedent is a member of that set – it does not block (53b). As said above, a VP with a pronoun referring to Bill is never licensed, as it does not contrast with the antecedent VP. Therefore only (53b) is licensed.

(54) a. $[\![\text{IP}_{(53a)}]\!]^f = \{\lambda w.x \text{ likes } x\text{'s mother in } w \mid x \in D_e\}$

b. $[\![\text{IP}_{(53b)}]\!]^f = \{\lambda w.x \text{ likes } y\text{'s mother in } w \mid x, y \in D_e\}$

In the present section we have shown that the assumption that AvoidF is an instance of MP! directly accounts for data that proved to be problematic for Schwarzschild's original formulation of AvoidF. We have seen that we can account for the data, once we allow for comparison of focus values in the sense that smaller focus values are preferred by MP!. The reason is that MP! naturally expands the set of competitors when comparing alternatives for focus licensing. In the following section, further properties of the proposed system are discussed.

3.5 Replicating Schwarzschild's results

In the present section I will show how the predictions of Schwarzschild's 1999 system are replicated by the present proposal in terms of focus values combined with Truckenbrodt's 1995 suggestion to replace AvoidF with MP!. Recall that in Schwarzschild's 1999 theory givenness is the main force that drives F-marking of material. Let me briefly review the two conditions he proposes: First each non-F-marked constituent in a clause must be given, whereas F-marked constituents need not be given. This is condition (4) from section 3.2. To be given as an individual-denoting expression means that there is an antecedent constituent in the context whose denotation is coreferential with that expression. For expressions of all other types the existentially type shifted version of the denotation of some antecedent entails the existentially type shifted denotation of the non-F-marked constituent, where all F-marks are replaced by existentially bound variables. Second, Schwarzschild uses the condition AvoidF (6) that

compares structures with and without F-mark and says that the one with the fewest F-marks satisfying givenness must be chosen.

The givenness condition (4) allows for given material to be F-marked, although it does not require it. Schwarzschild shows that this assumption is necessary. In (55), where the pronoun is coreferential to *John*, it is given as the context – the antecedent question – mentions John. Nevertheless the pronoun can and in fact must be focused.

(55) {Who did John's mother praise?}
A: She praised $[\text{HIM}]_F$
(Schwarzschild 1999:145)

Schwarzschild considers the F-markings A_1-A_5 in (55) as potential structures for the answer. The first one is the only possible one he argues.

(56) Who did John's mother praise?

A_1: She praised $[\text{HIM}]_F$

A_2: *[She praised him]

A_3: *[SHE_F praised him]

A_4: *[She PRAISED_F him]

A_5: *She $[[\text{PRAISED}]_F$ him$]_F$

Before showing how the present system accounts for the obligatory F-mark on the pronoun in (55), let us briefly discuss how Schwarzschild rules out all structures except for A_1. We will see that all other answers either violate givenness or AvoidF. In Schwarzschild's system we have to check whether each constituent that is not F-marked is given by the context. In the present case the context only contains the question. We assume Karttunen's 1977 semantics of questions. The existential type shift of the semantic value of the question, $\{p : \exists x[p = \textit{John's mother praised } x]\}$, is equivalent to $\exists x[\textit{John's mother praised } x]$ – that is, the existential type shift of

the question is the disjunction of all the answers.[17] This is the antecedent for the answers for which we check givenness.

First consider the grammatical A_1. The pronoun *she* is coreferential with *John's mother* and *him* with *John*, i.e. both count as given. They are left out in (57). But (57) shows that also for all remaining non-F-marked constituents there is an existentially type shifted antecedent that entails the existential F-closure of that constituent.

(57) *Given constituents*

a. *[She praised [HIM]$_F$]:*

$\exists x$[John's mother praised x] entails $\exists x$[John's mother praised x]

b. *[praised [HIM]$_F$]:* $\exists x$[John's mother praised x] entails $\exists x.\exists y$[y praised x]

c. *[praised]:* $\exists y$[John's mother praised y] entails $\exists x.\exists y$[y praised x]

But why is the F-mark obligatory, i.e., why is AvoidF that pushes for less F-marks not violated? Consider the ungrammatical A_2. Since A_2 is wholly non-F-marked, there should be antecedents that entail *John's mother praised John* and $\exists x$*[x praised John]*, the existential F-closures of the IP and the VP, respectively. The existentially type shifted question does not entail this, however. A_3 is ruled out for essentially the same reason. Since the subject is F-marked in this case, the existential F-closure of the IP and the VP collapse to $\exists x$*[x praised John]*. As we have already seen during the discussion of A_2, this is not given.

The existential F-closure of the IP in A_4, on the other hand, is $\exists R$*[R(John's mother,John)]*. But again, there is no antecedent that entails that there is some relation between John and John's mother.[18] The VP is not given either by any constituent. I leave the verification of this to the reader. When we consider A_5, we see that each non-F-marked constituent is given. In addition

[17] See (Schwarzschild 1999:152) for an exact definition of existential type shift. For the present purposes it seems enough to intuitively grasp the main idea.

[18] See (Schwarzschild 1999:160 fn.5), where he claims that the expression *John's mother* might not entail that John has a relation to John's mother, but that it might rather be a presupposition. Moreover, he speculates that *R* might stand in for verbal predicates and that a nominal predicate might not be an instantiation for this variable. By this reasoning the givenness of *John's mother* does not entail that there is a relation between John and John's mother.

to the pronouns *she* and *him*, the whole IP counts as given (58). Note that the pronoun *him* itself is not F-marked, but it is dominated by an F-mark.[19]

(58) *[She [[PRAISED]$_F$ him]$_F$]:*

$\exists x$[John's mother praised x] entails $\exists R$[R(John's mother)]

But in this case AvoidF is violated because *[She [[PRAISED]$_F$ him]$_F$]*, A_5, has more F-marks than *[She praised [HIM]$_F$]*, A_1. As both satisfy givenness, the latter is preferred. This is the desired outcome.

Let us now see whether the present theory can replicate Schwarzschild's results. We assume that the potential LFs are as in (56) above with the only difference that a $\sim$-operator together with a contextually determined set of alternatives is adjoined to each answer. Recall once more that the ordinary semantic value of the antecedent question is {p : $\exists x[p = \lambda w$.*John's mother praised x in w*]}. The focus value of A_1 is (59). The question denotation is necessarily a subset of (59), i.e., the focus principle is satisfied.

(59) $[\![A_1]\!]^f = \{\lambda w$.John's mother praised x in $w \mid x \in D_e\}$

Consider answer A_2, which has the focus value in (60). The denotation of the question is not a subset of $[\![A_2]\!]^f$. It could only be so if the set of answers were only a singleton. Thus FR is not satisfied by A_2.[20]

(60) $[\![A_2]\!]^f = \{\lambda w$.John's mother praised John in $w\}$

[19]Note that the F-marking indicated in A_5 is argued to be possible by many works following Selkirk (1984) (also cf. Rochemont (1986)), where it is assumed that if a syntactic head is F-marked, then this F-mark can project to the phrase level. Moreover F-marking of an internal argument licenses an F-mark on the head selecting for the internal argument (see Selkirk (1996)).

[20]In case questions denote the set of true answers, instead of possible answers, as proposed by Karttunen (1977), it could happen that the semantic value of the antecedent is a subset of $[\![A_2]\!]^f$. I am following Hamblin (1973) and other work more closely in assuming that the denotation of a question is the set of possible answers. In particular see Beck and Rullmann (1999) for arguments that this is the correct approach.

Answer A_3, on the other hand, denotes the set of propositions where different people praise John. Clearly, the denotation of the antecedent question is not a subset of this focus value either, i.e., A_3 does not satisfy the focus principle:

(61) $[\![A_3]\!]^f = \{\lambda w.x \text{ praised John in } w \mid x \in D_e\}$

A_4 is ruled out for similar reasons as A_3. The question denotation cannot be a subset of the possible relations holding between John's mother and John:

(62) $[\![A_4]\!]^f = \{P(\text{John's mother,John}) \mid P \in D_{\langle e\langle e,st\rangle\rangle}\}$

Consider now A_5. Its focus value denotes John's mother's potential properties:

(63) $[\![A_5]\!]^f = \{P(\text{John's mother}) \mid P \in D_{\langle e,st\rangle}\}$

Notice that the F-mark on the verb does not contribute to this focus value at all. A_5, too, is ruled out by our considerations. In Schwarzschild's account it was blocked by AvoidF. In other words, there is a more economical version than A_5. This also holds for the modified account where MP! takes its place. In particular, the set in (59), the focus value of A_1, is a proper subset of (63). As we have seen, (59) is licensed. Thus MP! prefers A_1 over A_5.

We have thus carried over Schwarzschild's explanation for the intriguing question-answer data. Notice that in the new account it suffices to check whether the ordinary value of the antecedent sentence is a subset of the focus value of the whole focus utterance. We have not felt the need to apply this checking to any subconstituents of the latter as in Schwarzschild's account.

3.6 Conclusion

In the present paper I have advanced the following claim: The competitor set necessary for focus licensing must be enlarged. In particular, it was suggested that if two structures share

their denotation, then they are both equally relevant for focus licensing. It was shown that this is a direct prediction of the theory advocated by Truckenbrodt (1995) whereby AvoidF should be seen as an instance of MP!. The second contribution I hope to have made is to have shown that Schwarzschild's 1999 insight that structures without F-marks are more economical than ones with can be easily incorporated into a system making use of focus values.

Chapter 4

Domain alternatives cause intervention effects in wh-questions

4.1 Introduction

The present chapter deals with intervention effects. It has been observed (Beck 1996a,b) that the presence of certain elements causes unacceptability of questions with a wh-in-situ expression if the latter linearly follows the respective element. Consider the difference between the German examples in (1) and (2). (1) contains the wh-in-situ expression negative which linearly follows the negative quantifier. Assuming for now that wh-words in general take clausal scope, one could say that the negative quantifier intervenes between the wh-in-situ and its potential scope site. Thus, (1) is an instance of the so-called intervention effect. On the other hand, if the quantifier is replaced by a proper name as in (2), the question becomes acceptable.

(1) *Wen hat niemand wo gesehen?
whom has nobody where seen
'Where did nobody see whom?'

(Beck 1996a:1)

(2) Wen hat der Hans wo gesehen?
whom has the Hans where seen

'Where did Hans see whom?'

The problem presented by data like (1) and (2) is how to capture the difference in interpretability between them. The general intuition behind most analyses, as we will see, is that the quantifier in (1) inhibits a relationship between the wh-in-situ expression and a question (Q)-operator located somewhere around CP, whereas a simple DP like *der Hans* does not cause any such effect. In principle there are two ways to go when trying to implement this idea: First, one can try to blame the intervention effect on the syntax – that is, the Q-operator cannot undergo some sort of syntactic relation with the wh-in-situ element. The immediate problem one faces when exploring this direction is that the Q-operator has no problem establishing a parallel relation with wh-elements that undergo overt movement but whose trace is positioned in the scope of a potential intervener. I.e., why can overt movement salvage a wh-question from showing an intervention effect? (1), for instance, becomes grammatical as soon as the adverbial *wo* is left out. But the object *wen* itself must be positioned in the scope of the quantifier before overt movement takes place. So the task for such an analysis is to find a suitable way of differentiating between moved and non-moved wh-elements when it comes to evaluating the syntactic relationship under discussion between the Q-operator and the wh-expression.

The second route is to claim that the relationship is prohibited for semantic reasons, which means that the intervening quantifier blocks semantic evaluation of the wh-in-situ expression due to its own semantic specification. For this to work it seems necessary that the wh-in-situ element is interpreted in its overt position. The semantic information provided by the wh-in-situ element must be accessible by the Q-operator. Moreover, it must be assumed that the intervening element can access this information as well. In particular, it must do so by default so that the Q-operator has nothing to evaluate anymore. In other words, the intervener unselectively uses all the semantic information in its scope. The problem at hand is to state this process in such a way that it does not block similar semantic relations in other cases. For instance, binding usually does not work this way, which suggests that it is not the correct process at work.

In the present chapter I show that both strategies essentially face the same problem among other difficulties which will also be discussed. Not all interveners of the same syntactic and semantic class cause intervention effects. This means that there must be some leeway built into the process blocking the relationship between the Q-operator and the wh-in-situ expression. Most analyses, however, do not provide for this. The fact that certain expressions cause intervention effects – in the present case downward-entailing (DE)-indefinites – whereas very similar expressions – that is, upward-entailing (UE)-indefinites – do not, suggests that ultimately an explanation of intervention effects should be semantic in nature. I will provide such an analysis. The key feature of this approach is that it dispenses with the intuition described above: The Q-operator is not prohibited from establishing a relationship with the wh-in-situ expression. It is assumed that wh-expressions are interpreted in the position they are pronounced. The intervention effect arises from the way the semantic interpretation procedure for wh-questions is set up alone. In particular, it is the scope relation between the intervening element and the wh-in-situ that proves to be problematic in constructions exhibiting intervention effects. In case the wh-expression is moved overtly, the scope relation is reversed and no difficulties arise. The particular way the scope difference is put to use in order to explain intervention effects is as follows: Assuming a Hamblin (1973)/Karttunen (1977) denotation for questions, I suggest that wh-expressions are interpreted as existential quantifiers. Following Rooth (1985) each constituent is equipped with two semantic values, namely an ordinary value and a set of alternative values. Each wh-expression introduces a domain of quantification for the existential quantifier in the ordinary value. The alternatives for a wh-expression are a set of existential quantifiers that differ in their domains of quantification: The domains are restricted to being subsets of the domain chosen in the ordinary value (cf. the analysis of NPIs in Chierchia (2004, 2006) discussed in subsection 4.7.2). This means that for each CP containing a wh-expression a normal value and a set of alternative values is derived. The function of the Q-operator is to extract those alternatives from this set that have singleton domains and make them the question denotation. However, it requires that the disjunction of these alternatives is equivalent to the ordinary value of CP. If that requirement is fulfilled, the question denotation is equivalent to

the Hamblin/Karttunen denotation. In case the alternatives are not ordered by disjunction in the way just described, the question denotes the empty set. As will be seen, in constructions with intervention effects the set of alternatives is not ordered by disjunction and uninterpretability is predicted. It is shown that whenever the wh-element is moved around the intervener to be interpreted in the position moved to, the intervention effect disappears, as now the alternatives are ordered by disjunction. It is a straightforward prediction of this proposal that not all intervening quantificational expressions behave alike. It will be argued that this is desirable. Moreover, I argue for a grammar where different syntactic representations are built in parallel and filtered by the interpretive systems. In particular, it is argued that the semantic component filters representations that would lead to an intervention effect. In other words, the grammar does not allow for wh-questions whose denotation is the empty set. This predicts empirical differences in the presence of intervention effects between German, on the one hand, and English, on the other hand. That is, the present chapter provides support to the assumption that syntax per se does not differentiate between grammatical and ungrammatical structures (cf. Chomsky (2004)). Rather it is the interpretive components that rule certain constructions unacceptable.

The chapter is structured as follows: In section 4.2, the problem caused by data such as (1) is characterized and it is shown that syntactic approaches are too coarse in that they do not predict differences in interpretability between intervening elements. In section 4.3 a new empirical generalization based on the discussion in the preceding section is introduced. Section 4.4 introduces the assumptions made about the interpretation of wh-questions taking into account the insight from section 4.3. In the subsequent section 4.5, it is shown that these assumptions directly predict intervention effects. Section 4.6 discusses predictions of the present analysis. In section 4.7, I compare the present approach to some existing semantic analyses of intervention effects and show how the latter differ from the former. In particular, I argue that the data from section 4.2 prove problematic for some of the theories, as well. Section 5.9 concludes the chapter and provides a brief outlook.

4.2 The puzzle of intervention effects

In the present section, I outline the problem associated with constructions exhibiting intervention effects. I will first show that a syntactic analysis is not suitable for explaining the unacceptability. Then I proceed to show that it is also not immediately clear how a semantic analysis could capture the effect because the class of interveners does not form a natural semantic class at first sight.

4.2.1 Why a syntactic analysis must fail

Beck (1996a,b) notices that in German wh-expressions when in situ cannot be dominated by a negative expression intervening between the wh-expression and the question (Q)-operator, where it is assumed that the Q-operator is positioned somewhere in the CP-domain. (3) is uninterpretable because the negative quantifier *kein Junge* intervenes between Q and the wh-in-situ expression *wann*. (3) is a so-called intervention effect. If, on the other hand, *when* is scrambled across the quantifier, the sentence becomes acceptable (4).

(3) *Wen hat kein Junge wann angerufen?
who has no boy when called

(4) Wen hat wann kein Junge angerufen?
who has when no boy called
'Who did no boy call when?'

This effect is stable across the range of downward entailing (DE-) quantifiers:

(5) a. *Wen hat niemand wann angerufen?
who has no one when called

b. Wen hat wann niemand angerufen?
who has when no one called
'Who did no one call when?'

(6) a. *Wen hat der Hans nie wem vorgestellt?
who has the Hans never whom introduced

b. Wen hat der Hans wem nie vorgestellt?
who has the Hans whom never introduced
'Who did Hans never introduce to whom?'

Following observations by Fanselow (1990) it must be noted that scrambling of wh-in-situ expressions is normally impossible (7) (cf. the discussion in (Pesetsky 2000:78f.) and the references there). It thus seems that scrambling of wh-in-situ expressions only becomes an option if an intervention effect arose otherwise.[1]

(8) a. Wen hat der Hans wem vorgestellt?
who has the Hans whom introduced
'Who did Hans introduce to whom?'

b. *Wen hat wem der Hans vorgestellt?
who has whom the Hans introduced

Because of the fact that scrambling obviates intervention effects, it might be thought that an analysis based on minimality (cf. Chomsky (1986), Rizzi (1990) a.m.o.) is tenable. If the Q-operator must be coindexed with the wh-in-situ expression, then it might be possible to claim that the intervening negation in the examples above disrupts this relationship because minimality is violated. For the discussion to follow we can assume the naive definition of the minimality principle given in (9).

(9) *Minimality principle*

α and β can be coindexed iff there is no intervening γ such that α could be coindexed with γ.

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[1]Note that the pattern in (8) cannot be explained by recourse to superiority. The data in (i) show that both wh-elements can be moved equally well. In other words, no superiority effects exists in (i), and neither is one expected in (8).

(7) a. Wen hat der Hans wem vorgestellt?
who has the Hans whom introduced
b. Wem hat der Hans wen vorgestellt?
whom has the Hans who introduced
'Who did Hans introduced to whom?'

There are two ways to implement this intuition. For the first option assume that wh-in-situ expressions must be covertly moved to Spec,CP. In order for this to happen, the Q-operator located in C must be coindexed with the wh-element. Moreover, assume that the Q-operator can also be coindexed with an intervener referred to as Op, i.e., Op should also be able to move to Spec,CP. Under these assumptions, the representation in (10a) would result in a violation of the minimality principle. Q is coindexed with the wh-element, although Op would be closer to Q, and Q could be coindexed with Op. The representation in (10b) is fine according to minimality. But the wh-expression is not coindexed with Q. Thus the wh-element cannot be moved to Spec,CP, which violates our first assumption. The only way to circumvent this problem is to overtly move the wh-element around Op. Now it is the closest element to Q that can be coindexed with it.

(10) a. $[_{C'}\ Q_i\ [\ \ldots Op \ldots [\ \ldots wh_i \ldots]]]$

b. $[_{C'}\ Q_i\ [\ \ldots Op_i \ldots [\ \ldots wh \ldots]]]$

c. $[_{C'}\ Q_i\ [\ \ldots wh_i \ldots [\ \ldots Op \ldots [\ \ldots t \ldots]]]]$

The problem with this view is, as pointed out by (Beck 1996a:18), is that the minimality principle in (9) does not discriminate between overt and covert movement. In fact, most other constructions where minimality is put to use involve overt movement that is banned because of (9). But as we already know overt wh-movement around an intervener must not be blocked.

A second possible way of implementing (9) for intervention effects goes as follows: Wh-expressions need not move covertly to Spec,CP – that is, they are interpretable in their overt position, possibly by an approach like Reinhart's 1998 choice function treatment of wh-in-situ expressions. But wh-elements must be licensed by the Q-operator situated in C, which means that they must be coindexed with the operator. Op, however, could also be coindexed with wh-elements. Consider the structures in (11) under these assumptions. In the representation (11a) the wh-expression is licensed, as it is coindexed with Q. But a violation of minimality occurs because Op could also be coindexed with the wh-element. If (11b) is chosen as the underlying representation, the wh-element is not licensed because it is not coindexed with Q. Thus only structure (11c) is licensed; the wh-expression is moved overtly over Op and can be coindexed

with Q without any minimality effect obtaining.

(11) a. $[_{C'}\ Q_i\ [\ \ldots Op \ldots [\ \ldots wh_i \ldots]]]$

b. $[_{C'}\ Q\ [\ \ldots Op_i \ldots [\ \ldots wh_i \ldots]]]$

c. $[_{C'}\ Q_i\ [\ \ldots wh_i \ldots [\ \ldots Op \ldots [\ \ldots t \ldots]]]]$

However, the reasoning above relies on the assumption that coindexation relations are checked after the complete structure has been built. This is presumably not tenable. Rather Op would already have to be coindexed with the wh-element before overt movement of the latter, which would mean that a minimality effect should be detectable in (11c) after all. This would further mean that any overt wh-movement should be blocked under these assumptions, as well. A second potential problem is that it is not clear why Op should be able to be coindexed with wh-expressions. There is simply no reason why this should be required apart from trying to derive intervention effects from minimality. In sum, it seems that intervention effects are not connected to the theory of minimality.

For reasons such as the ones just discussed, Beck (1996a,b) and Beck and Kim (1997) argued that intervention effects caused by quantifiers are evidence for a level of syntactic representation different from surface structures – that is, there is a level, LF, where covert movement applies, which can be identified by its own locality conditions. In particular, Beck assumed a Hamblin (1973)/Karttunen (1977) semantics for questions. In order to derive such denotations she moreover assumed that wh-expressions need to undergo movement to the Q-operator. In the case of wh-in-situ expressions this movement is covert. To account for intervention effects, Beck formulates the definition in (12) and the condition in (13) dependent on it. It is crucial that (13) applies at LF. (12) and (13) taken together make quantifiers islands for LF-movement. That is, covert movement cannot cross a quantifier because the binder for the trace would be c-commanding the QUIB.[2]

[2]Hagstrom (1998) and Pesetsky (2000) have similar syntactic analyses for intervention effects found with wh-in-situ questions. Pesetsky, in addition, distinguishes between covert phrasal movement and feature movement. Only the latter type of movement is subject to quantifier induced LF-islands.

(12) *Quantifier-Induced Barrier (QUIB):*

The first node that dominates a quantifier, its restriction, and its nuclear scope is a Quantifier-Induced Barrier.

(Beck 1996a:39)

(13) *Minimal Quantified Structure Constraint (MQSC):*

If an LF trace β is dominated by a QUIB α, then the binder of β must also be dominated by α.

(Beck 1996a:39)

According to this view example (4) is good, because the wh-in-situ expression is not inside the QUIB caused by the negative quantifier at surface structure. Therefore after covert movement the trace is not inside the QUIB either. (13) is satisfied. In the case of the ungrammatical (3), on the other hand, surface structure and LF are again distinct, but the trace of the wh-in-situ expression is not bound from inside the QUIB. (13) is violated. It should be stressed once more that, if viewed this way, intervention effects provide direct evidence for a level of syntactic representation distinct from surface structure:

(14) a. *Surface structure for (4)*

wen 1[Q hat wann [$_{\text{QUIB}}$ kein Junge t_1 angerufen]]

b. *LF for (4)*

wann 2[wen 1[Q hat t_2 [$_{\text{QUIB}}$ kein Junge t_1 angerufen]]]

(15) a. *Surface structure for (3)*

wen 1[Q hat [$_{\text{QUIB}}$ kein Junge t_1 wann angerufen]]

b. *LF for (3)*

wann 2[wen 1[Q hat [$_{\text{QUIB}}$ kein Junge t_1 t_2 angerufen]]]

The analysis presented is descriptively adequate, but like most approaches positing islands it is tempting to derive the nature of the islandhood of quantifiers from independent factors. In

particular, the fact that intervention effects only arise with wh-in-situ expressions and not with overtly moved wh-expressions is particularly urging us to ask how the LF islands come about. Moreover there is an empirical problem with this analysis. It predicts that all quantifiers lead to intervention effects in the same way. This is not correct. In the examples below it can be seen that upward-entailing (UE) indefinites, on the one hand, do not lead to intervention effects or maybe to very weak ones, (16a)-(19a). DE-indefinites, on the other hand, lead to strong uninterpretability, (137)-(140).[3] [4]

(16) a. ?Wen haben mindestens zwei Studenten wem vorgestellt?
who have at least two students whom introduced
'Who did at least two students introduce to who?'

b. *Wen haben höchstens zwei Studenten wem vorgestellt?
who have at most two students whom introduced

(17) a. ?Wen hat mindestens ein Student wem vorgestellt?
who has at least one student whom introduced
'Wen hat mindestens ein Student wem vorgestellt?'

b. *Wen hat höchstens ein Student wem vorgestellt?
who has at most one student whom introduced

(18) a. ?Wen haben mehr als drei Studenten wann eingeladen?
who have more than three students when invited
'Who did more than three students invite when?'

b. *Wen haben weniger als drei Studenten wann eingeladen?
who have less than three students when invited

(19) a. ?Wen haben einige Regisseure in welchem Film gesehen?
who have a few directors in which film seen
'Who did a few directors see in which film?'

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[3] Beck (1996a) already notes that there is a difference between UE- and DE-indefinites and that this is a potential problem for her analysis. But she nevertheless maintains that both lead to intervention effects. As far as I can see, she does so mainly on the basis of keeping a uniform analysis. Beck, however, does not note that the difference is quite systematic, as can be seen from the examples in the text.

[4] UE- and DE-functions are defined as follows:

(i) a. Function f is UE iff for any a and b such that $a \subseteq b$, $f(a) \subseteq f(b)$.
b. Function f is DE iff for any a and b such that $a \subseteq b$, $f(b) \subseteq f(a)$.

b. *Wen haben wenige Regisseure in welchem Film gesehen?
who have few directors in which film seen

Why are the examples with intervening UE-indefinites judged as not fully grammatical? I want to suggest that this mild intervention effect is due a scalar implicature generated by the UE-indefinite. In particular, let us assume that an UE-indefinite in a proposition like *at least 3 students P* triggers a scalar implicature to the effect that *not all students P*. This scalar implicature itself contains a negation. I.e., if DE-elements induce intervention effects and such effects are semantic in nature, it is predicted that the scalar implicature causes such an effect as well.[5] [6] This predicts that the slight degradedness of the examples above should disappear if the scalar implicature associated with the intervening UE-indefinite is not generated. (20) is an example supporting this prediction. The context is chosen in such a way that it is unlikely that a negative scalar implicature is generated. The wh-question with an intervening UE-indefinite becomes even more acceptable than before.

(20) *Context*: The department requirements are such that every student has to invite a professor to a restaurant once per academic year. There are five students and three professors in the department. Moreover there are only three restaurants that the students can afford. We know that at least one professor has been invited to one and the same restaurant more than once. But we do not know which students and how many invited him there. We ask:

a. Welchen Professor haben mindestens zwei Studenten wohin eingeladen?
which professor have at least two students where invited
'Which professor was invited where by at least two students?'

(21) is a further case supporting the conclusion that the negative scalar implicature of the UE-indefinite is the cause of slight degradedness in the examples above. Once this potential con-

[5]Note moreover that a universal quantifier is also present in the scalar implicature. As we will see, such operators also cause intervention effects.

[6]Chierchia (2004) argues that the scalar implicature associated with a universal quantifier intervening between a negative operator and an NPI-element causes an intervention effect in a way similar to the one argued for in the text. See subsection 4.7.2 below for more discussion.

found is eliminated, the wh-questions become fully acceptable.

(21) *Context:* At EU-summits there are five spokespersons. Each member state has to book one of these ahead of the meeting, i.e., each spokesperson gets booked by more than one country. One of the spokespersons is very efficient and is preferred by all the countries. That person could be booked by all countries. We do not know who is booked more than once and ask:

a. Welchen Sprecher haben mindestens zwei Länder bei welchem Treffen
which speaker have at least two countries at which summit
gebucht?
booked
'Which speaker was booked by at least two countries at which EU-summit?'

The data above pose a problem for a syntactic analysis of intervention effects. The systematic differences between UE- and DE-indefinites suggests that a semantic cause is the root of intervention effects. But syntactic analyses, no matter whether they are based on minimality or on LF-islands, are not sensitive to semantic differences.[7] Moreover, a syntactic analysis would not predict that elimination of a scalar implicature ameliorates the slight intervention effect with UE-indefinites. In fact, it is difficult to see how such an approach would deal with intervention effects caused by scalar implicatures at all. Arguably the scalar implicature is not part of the syntactic structure. Therefore neither minimality nor an LF-island approach would have anything to say about the effect discussed above.

I will now show that interveners causing degradedness do not fall into a natural semantic class.

[7]Note that the only potential way for an LF-island analysis to make sense of the data above is to stipulate that LF has some sort of negative islands distinct from islands at surface structure. This way the examples with UE-indefinites would not lead to islands. This view, however, also cannot be maintained, as will be seen in the next subsection.

4.2.2 Why a semantic generalization is not readily available

Given that there is a systematic difference between UE- and DE-indefinites in their ability to induce intervention effects, one might be tempted to blame uninterpretable wh-in-situ questions on DE-environments. Remember that negative quantifiers and negation in general leads to intervention effects. According to this hypothesis we would assume that whenever a wh-expression is in a DE-environment, uninterpretability results for some reason to be specified. This means that wh-expressions in at least German are interpreted in their overt position. In the examples discussed so far, the wh-in-situ expression is in a DE-environment because the c-commanding negative operator is DE on both its arguments.

Beck (1996a) notes that intervention effects also arise with universal quantifiers. Consider (22). Although the example is not strictly uninterpretable, (22) is unambiguous, whereas the minimally differing alternative in (23) is not. (22) only has the distributive or pair-list reading (22a). The single answer interpretation in (22b) is blocked. Beck assumes with Chierchia (1992), Groenendijk and Stokhof (1984), and Higginbotham (1993) that the pair-list interpretation obtains when the universal quantifier has scope over the entire question (or alternatively over the question-act as argued by Krifka (2001)) – that is, it must have scope over the Q-operator. Thus the quantifier does not intervene between the wh-in-situ expression *wann* and Q anymore. If *wann* is scrambled across the universal quantifier, on the other hand, the single answer interpretation becomes available (23). It is assumed that this is so because the quantifier does not intervene between the wh-expression and Q anymore.

(22) Wen hat jeder Junge wann beobachtet?
who has every boy when observed
a. 'For every boy, who did he observe when?'
b. *'Who is such that every boy observed him when?'

(23) Wen hat wann jeder Junge beobachtet?
who has when every boy observed
a. 'For every boy, who did he observe when?'
b. 'Who is such that every boy observed him when?'

Universal quantifiers are not DE on their second argument. This means that the wh-in-situ expression in (22) is not anymore in a DE-environment than the one in (23). Both are in an UE-environment. That the universal quantifier is not DE on its second argument can be seen by the fact that sentence (24a) does not entail (24b). The property denoted by *smokes cigars* is a subset of the property denoted by *smokes*, i.e., the former entails the latter. If *every* were DE on its second argument, the inference from (24a) to (24b) should hold. Since it does not hold, the availability of intervention effects with universal quantifiers contradicts the hypothesis that DE-environments per se are the cause intervention effects in wh-questions.

(24) a. Every student smokes

b. Every student smokes cigars

In addition it has been noticed by Kim (2002) and Beck (2006) that focus also causes intervention effects. As can be seen by (25a) and (26a), a focused subject has the consequence that a wh-in-situ expression is blocked from associating with the Q-operator. Both *nur* and *sogar* have this effect. If the wh-expression is scrambled, the intervention effect disappears, (25b) and (26b).

(25) a. *Wen hat nur der HANS wann angerufen?
who has only the Hans when called

b. Wen hat wann nur der HANS angerufen?
who has when only the Hans called
'Who did only Hans call when?'

(26) a. *Wen hat sogar der HANS wann angerufen?
who has even the Hans when called

b. Wen hat wann sogar der HANS angerufen?
who has when even the Hans called
'Who did even Hans call when?'

Similar effects can be found in typologically unrelated languages. Kim (2002) discusses for instance the following data from Korean establishing a parallel paradigm. Focus operators such

as *only* (27) and *also* cause intervention when the wh-element is in-situ, (27a) and (28a) respectively. If the wh-expression moves around the offending intervener, the effect is obliterated, (27b) and (28b).[8]

(27) a. ?*Minsu-man nuku-lûl manna-ss-ni?
Minsu-only who-Acc meet-Past-Q

b. nuku-lûl$_i$ Minsu-man t$_i$ manna-ss-ni?
who-Acc Minsu-only meet-Past-Q
'Who did only Minsu meet?'

(Kim 2002:(11))

(28) a. ?*Minsu-to nuku-lûl manna-ss-ni?
Minsu-also who-Acc meet-Past-Q

b. nuku-lûl$_i$ Minsu-to t$_i$ manna-ss-ni?
who-Acc Minsu-also meet-Past-Q
'Who did Minsu, too, meet?'

(Kim 2002:(12))

The problem is that *only* is not DE on neither of its arguments as discussed among others by Atlas (1996), von Fintel (1999), and Wagner (2006a). To see this consider the sentences in (29). Sentence (29b) without only entails sentence (29a) without *only*. The proposition that John smokes cigars is true in a subset of worlds where the proposition that John smokes is true, which means that the entailment relationship is an instantiation of upward entailment. If *only* were DE, sentence (29a) with *only* should entail sentence (29b) with *only*. But it does not.

(29) a. (Only) John smokes

b. (Only) John smokes cigars

von Fintel (1999) notices that a weaker form of downward entailment holds between (29a) and (29b) which he refers to a Strawson entailment. He maintains that (29a) entails (29b) if the

[8]The picture is not as perfectly parallel when it comes to quantifiers, as not all quantifiers show intervention effects in Korean. We will come back to this question in subsection 4.6.3 below.

presupposition of (29b) is assumed to hold. According to Horn (1969) a.o. a sentence like (29b) presupposes the truth of the prejacent – that is, the sentence without *only*. If it is assumed that John smokes cigars, then the proposition that only John smokes entails that only John smokes cigars. Thus it might be possible after all to maintain for *only* that DE-environments are responsible for intervention effects.

What about *even*? According to Karttunen and Peters (1979) (also cf. Rooth (1985), Guerzoni (2004) a.o.) the conventional implicature associated with (30b) is as in (31). Horn (1969) assumes a weaker presupposition. Thus assuming his analysis would not change the argumentation to follow. When the truth of (31) is assumed, (30a) still does not entail (30b). The conventional implicature (31) and (30a) together can be true in a situation where John does not smoke cigars.

(30) a. Even John smokes

b. Even John smokes cigars

(31) For all alternatives x to *John*, x smoking cigars is more likely than John smoking cigars

Therefore, it does not seem that the hypothesis concerning DE-environments and intervention effects can be maintained. Although, *only* can be claimed to be Strawson-DE, this does not extend to *even*. Universal quantifiers are clearly not Strawson-DE either, as their is no comparable conventional implicature or presupposition triggered in these cases. This moreover means that the natural semantic class which we were after when we formulated our hypothesis cannot be upheld either. Since it was also concluded that a syntactic analysis of intervention effects is out of the question due to the fact that the monotonicity of the potential interveners seems to have an effect, it seems that we have to look for a new semantic generalization.

4.3 Disjunction

I now want to point out a fact that differentiates between UE-indefinites and the other potential interveners, namely disjunction. In particular it is shown below that the operators Q inducing

intervention effects are such that the equivalence in (32) is not given. For operators which do not trigger intervention effects, however, the equivalence in (32) can be observed. Thus there is a systematic semantic classification that distinguishes between interveners and non-interveners.[9]

(32) $Q.\phi \vee Q.\psi = Q.\phi \vee \psi$

We first note that UE-indefinites can be seen as existential quantifiers ranging over their witness sets (Barwise and Cooper 1981). According to this view, DE-indefinites must be treated as negated existential quantifiers ranging over their witness sets. Following Barwise and Cooper (1981) a witness set is defined as follows:

(33) A *witness set* for a quantifier $D(A)$ living on A is any subset w of A such that $w \in D(A)$. (Barwise and Cooper 1981:191)

A witness set for *some student* is a non-empty set of students, whereas a witness set for *every student* is the set of all students. Accordingly, the UE-indefinite *at least two students*, on the one hand, has as a witness set any set with two or more students. The DE-indefinite *at most two students*, on the other hand, has as witness set any set with two or less students. Thus in the following, statements involving existential quantifiers should be seen as encompassing statements involving UE-indefinites, and such with negated existential quantifiers as encompassing statements involving DE-indefinites.

Consider first the formula in (34). It is easy to see that the statement on the left and the one the right side are equivalent. The left side of the equation denotes the proposition that is true in all worlds where P holds of some individual, or where Q holds of some individual, or both. Assume that the right side is false, i.e., there is no individual for who P or Q holds. Then the left side cannot be true either because both its disjuncts are necessarily false. Now assume that the right side is true, i.e., there is an individual such that P or Q is true of that individual. In that situation, it cannot be the case that there is no individual of who P holds and that there is no

[9]For some pertinent discussion of such equivalences see (Partee et al. 1990:148f.) a.o.

individual of who Q holds. The right side therefore entails the left side, as well. In other words, the equivalence statement in (34) holds.

(34) $\exists x.P(x) \vee \exists x.Q(x) = \exists x[P(x) \vee Q(x)]$

Consider now the formula in (35). Assume that the world is such that there is no individual such that it makes P true, but that there is an individual that makes Q true. In that situation the left side as a whole is true. The right side, however, is false under these assumptions as it requires that no individual makes P nor Q true. Thus, the left side does not entail the right side. The right side is true if no individual makes P or Q true. In that situation, both disjuncts on the left side are true, and therefore the disjunction as a whole is true. As a consequence, entailment goes from right to left in (35), and equivalence does not hold.

(35) $\neg\exists x.P(x) \vee \neg\exists x.Q(x) \neq \neg\exists x[P(x) \vee Q(x)]$

Similarly, equivalence fails to hold between the left and the right side of the non-equal symbol in (36). The statement on the left is true if P holds of everyone, or Q does, or both. It is easy to see that the right side cannot be false in that situation, i.e., the left side entails the right side. Assume now that the world is such that some individuals make P true but not Q, whereas some others make Q true but not P. Then the right side is true. But the left side is false as it requires that every individual satisfies P or Q, or both. In sum, the entailment goes from left to right in (36). But again equivalence does not hold.

(36) $\forall x.P(x) \vee \forall x.Q(x) \neq \forall x[P(x) \vee Q(x)]$

Consider now the formula in (37) which is supposed to represent a statement containing *only*. Again non-equivalence holds between the two sides. Assume a world where it is true that y is the only individual satisfying P. But there are individuals other than y satisfying Q. In this situation the left side is true. The right side, on the other hand, is false because it requires that there are both no individuals other than y satisfying P nor any satisfying Q. The left statement

does not entail the one on the right. The one the right is true if all individuals other than y are such that neither P nor Q is true of them. Assume the left side is false: Then there must be an individual other than y making P true or there must be one making Q true. This cannot be. I.e., the right side entails the left side but not vice versa.

(37) $\forall x[x \neq y \rightarrow \neg P(x)] \vee \forall x[x \neq y \rightarrow \neg Q(x)] \neq \forall x[x \neq y \rightarrow \neg[P(x) \vee Q(x)]]$

Consider now (38) standing in for a statement containing *even*. $P(x) > P(y)$ expresses that the likelihood of $P(x)$ is higher than the one of $Q(x)$. The left side is true if either all individuals make P more likely than $P(y)$ or all individuals make Q more likely than $Q(y)$, or both. Assume now the right side is false: Then there must be an individual other than y making neither P more likely than $P(y)$ nor Q more likely than $Q(y)$. This is contradictory. Thus the left side entails the right side. Assume now the world is such that some individuals different from y make P more likely than $P(y)$ but not Q more likely than $Q(y)$, whereas others make Q more likely than $Q(y)$ but not P more likely than $P(y)$. In this situation, the right side of the statement is true. The left side, however, is false, and therefore the right side does not entail the left side. Non-equivalence holds.

(38) $\forall x[x \neq y \rightarrow P(x) > P(y)] \vee \forall x[x \neq y \rightarrow Q(x) > Q(y)] \neq \forall x[x \neq y \rightarrow P(x) > P(y) \vee Q(x) > Q(y)]$

In other words, existential quantifiers are the only operators of the ones investigated so far which obey the statement in (32). This is what we hoped for because we have seen that UE-indefinites do not cause intervention effects, whereas all the other operators discussed do. Note moreover that *only* according to the discussion above seems to pattern with negated existential quantifiers, whereas *even* patterns with universal quantifiers. If I am right in assuming that the obedience or disobedience of the equivalence statement in (32) is at the root of intervention effects, then it is no longer a mystery why seemingly unrelated operators behave the way they do. Of course, we have not explained yet why intervention effects exist. But let me already point out two

interesting facts now. First the effect of disjunction shown in this section is at its heart a scope effect: The mutual scope between two operators – that is between the one causing intervention and disjunction – matters when deciding whether the equivalence in (32) holds or not. This is important to see because intervention effects apparently also reduce to a scope effect. If the wh-in-situ expression has scope below the operator causing intervention, uninterpretability arises. If it takes scope above the operator, no such effect is detectable. Moreover, it is not entirely unexpected that disjunction should play a role in the explanation of intervention effects. Intuitively what a wh-question does is seek information; it asks which of $p_1, ...p_n$ is true. In other words it asks, whether $p_1 = 1 \vee ... \vee p_n = 1$. In the following section I will outline a system that makes use of these two properties. It will then be seen that intervention effects are straightforwardly predicted.

4.4 The syntax and semantics of wh-questions

I will assume a Hamblin (1973)/Karttunen (1977) semantics for wh-questions. In other words, the denotation of a wh-question is equivalent to a set of propositions. The question in (39) therefore has the meaning in (40). Intuitively one can think of the denotation in (40) as being the set of possible answers to the question, i.e., it has the form {that John saw Mary, that John saw Bill, . . . }.

(39) Who did John invite?

(40) $[\![(39)]\!]^g = \{p : \exists x[p = \lambda w.invite_w(John, x)]\}$

The question is of course how the meaning in (40) is compositionally derived from the syntax provided by the question. In the following I will argue for a new of doing so. I discuss the system in two steps. First I make the syntactic assumptions clear. Then I turn to the interpretative system.

4.4.1 The syntax of wh-questions

Consider a simple German multiple wh-question like (41).

(41) Wen hat der Hans wem vorgestellt?
who has the Hans whom introduced
'Who did Hans introduce to whom?'

Following recent developments (cf. Chomsky (2004), Reinhart (2006) a.o.), I assume that syntax does not provide just one possible representation for a wh-question like (41). Rather different competitor structures are generated. For German in particular, the structures in (42) are derived among possible further ones. Regarding the lower wh-expression it is possible that it stays in situ (42a). Moreover, it is possible to move, either overtly by scrambling (42b) or covertly by QRing (42c). In general, the in-situ version is the most economical output as it involves one derivational step less than the other options. We will, however, see in the following subsection that nevertheless a movement representation must be chosen for reasons of interpretation. A further assumption will be important later on: Overt movement is more economical than covert movement, except when covert movement is forced for reasons of interpretation. That is, a quantifier which is uninterpretable in object position must undergo QR (cf. Fox's 2000 obligatory QR which is not subject to scope economy). In this situation overt movement is not more economical than covert movement.

(42) a. Q [$_{CP}$ wen$_{[Q]}$ 1 [$_{C'}$ hat der Hans wem$_{[Q]}$ t_1 vorgestellt]]

b. Q [$_{CP}$ wen$_{[Q]}$ 1 [$_{C'}$ hat wem$_{[Q]}$ 2[der Hans $t_{2,overt}$ t_1 vorgestellt]]]

c. Q [$_{CP}$ wen$_{[Q]}$ 1 [$_{C'}$ hat wem$_{[Q]}$ 2[der Hans $t_{2,covert}$ t_1 vorgestellt]]]

As can be seen by the representations in (42), the Q-operator is assumed to be attached to the clausal node. Moreover, wh-elements must be evaluated by Q syntactically. That is, they must be in a feature relation with Q, as indicated above. The Q-operator provides the question meaning, which I will discuss in the following subsection. Note that according to the structures in (42) there is no reason for wh-elements to undergo covert movement to Spec,CP. In other

words, I will argue for a system below that lets wh-expressions be interpreted in their overt position. Once the semantic assumptions have been introduced, it will become clear that only one of the representations in (42) is licensed by the grammar.

4.4.2 The interpretative system

Following Rooth (1985) and much work after him, the semantic system is assumed to be bi-dimensional.[10] This means that each constituent is assigned two semantic values. One of them is the ordinary value, the other one is the alternative value. The alternative value is a set of values, namely the set of alternatives to the ordinary value. This means that the alternative value is a collection of values having the same semantic type as the ordinary value. Not all constituents make actual alternatives available for the computation. In this case the alternative value is identical to the singleton set containing just the ordinary value of that constituent. I assume that alternatives are activated by features specifying that the computation should consider the semantic alternatives to the constituent being marked by the feature. Following (Rooth 1985:14) the interpretation rules for ordinary values and alternative values are then as in (43), where Alt indicates both the feature on constituent A activating the alternatives and the alternative value of A.

(43) *Semantic values*

a. (i) $[\![\mathrm{A}_{Alt,\sigma}]\!]^g = g(A)$

(ii) $[\![\mathrm{A}_{Alt,\sigma}]\!]^{Alt} = D_\sigma$

b. (i) $[\![\mathrm{A}_\sigma]\!]^g = g(A)$

(ii) $[\![\mathrm{A}_\sigma]\!]^{Alt} = \{[\![\mathrm{A}_\sigma]\!]^g\}$

Following Hamblin (1973) and Rooth (1985) the rule of functional application can be defined as in (44) when dealing with sets. I assume that the rule in (44) is only necessary for the computation of alternative values. In other words, ordinary values do not correspond to sets.

[10]The following discussion repeats the assumptions from chapter 2 subsection 2.2.1, albeit in a more general fashion so that the system is applicable to phenomena involving semantic alternatives other than focus constructions.

(44) *Functional application*

Given branching node A with daughters B of type $\langle\sigma\tau\rangle$ and C of type $\langle\sigma\rangle$, $[\![\text{A}]\!]^{Alt}$ = $\{f(x) \in D_\tau : f \in [\![\text{B}]\!]^{Alt}$ and $x \in [\![\text{C}]\!]^{Alt}\}$.

The rule of predicate abstraction is a little bit more complicate to define. For simplicity I will adopt the predicate abstraction rule formulated in (45). What it does is to form a set of properties by abstracting over the ordinary value of the constituent the index is adjoined to under the modified assignment that is just like the normal assignment except that it replaces each instance of the numerical index by x and moreover replaces each alternative-inducing element with y. The latter variable is existentially quantified over.

(45) *Predicate abstraction*

If A is a branching node with daughters B of type $\langle\tau\rangle$ and a numerical index i, $[\![\text{A}]\!]^{Alt}$ = $\{f \in D_{\langle e,\tau\rangle} : \exists y[f = \lambda x.[\![\text{B}]\!]^{g[x/i],[y/Alt]}]\}$.

Where do alternatives come in in wh-questions? I will not follow assumptions made in the literature claiming that the denotation of a wh-element is a set of alternatives (cf. Hamblin (1973) and more recently Beck (2006), Hagstrom (1998), Kratzer and Shimoyama (2002), Shimoyama (2006), although the latter differ in their actual implementations). Rather I argue that wh-words are interpreted as existential quantifiers. These quantifiers range over a chosen domain. The wh-element is lexically marked as activating domain alternatives. In particular the domains must be subsets of the domain chosen in the ordinary value not including the empty set. These assumptions are parallel to the ones made by Chierchia (2004, 2006) for NPIs. See subsection 4.7.2 below for a comparison with this approach. This means that the ordinary value for the wh-morpheme is as in (46a), whereas the alternative value is as in (46b).

(46) a. $[\![\text{wh}]\!]^g = \lambda P.\lambda Q.\lambda w.\exists x \in D[P_w(x) \wedge Q_w(x)]$

b. $[\![\text{wh}]\!]^{Alt} = \{\lambda P.\lambda Q.\lambda w.\exists x \in D'[P_w(x) \wedge Q_w(x) \mid \emptyset \neq D' \subseteq D\}$

Assume for the moment that the domain $\{a, b, c\}$ is chosen in the ordinary value. Then the domain alternatives for the alternative value are as follows:

(47) $\{\{a\}, \{b\}, \{c\}, \{a, b\}, \{a, c\}, \{b, c\}, \{a, b, c\}\}$

For our example (41) above, we have to assume the LF in (48). Not only the leftmost wh-element undergoes movement. Since wh-expressions are interpreted as existential quantifiers, the wh-in-situ must move as well. This is therefore a case of obligatory QR. In other words, overt movement is not more economical than covert movement. This means that the movement of the wh-in-situ expression is covert. Our interpretive system delivers two semantic values for the CP-constituent. Each wh-expression is interpreted as an existential quantifier introducing a domain of quantification. Assume for expository reasons that we choose two non-overlapping domains for the quantifiers.

(48) Q [$_{CP}$ wen$_{[Q]}$ 1 [$_{C'}$ hat wem$_{[Q]}$ 2[der Hans t_2 t_1 vorgestellt]]]

(49) a. $[\![\text{CP}]\!]^g = \lambda w.\exists x \in \{a, b\}.\exists y \in \{c, d\}[introduce_w(Hans, x, y)]$

b. $[\![\text{CP}]\!]^{Alt} = \{\lambda w.\exists x \in D.\exists y \in D'[introduce_w(Hans, x, y)] \mid \emptyset \neq D \subseteq \{a, b\}, \emptyset \neq D' \subseteq \{c, d\}\}$

We immediately add that the members of the alternative value are ordered by strict entailment. That is, each alternative with two singleton domains asymmetrically entails two alternatives with one singleton domain and one two-member domain and the alternative where both domains contain two members. To see this, notice that the alternatives with single member domains only are equivalent to non-quantificational propositions. In other words, the proposition $\lambda w.\exists x \in \{a\}.\exists y \in \{c\}[introduce_w(Hans, x, y)]$ is equivalent to the proposition $\lambda w.introduce_w(Hans, a, c)$. Now, if Hans introduced a to c, then it must be the case that there is some individual in $\{a, b\}$ such that Hans introduced that individual to one of $\{c, d\}$. This means that the alternatives are ordered as in (50).

(50)
$$\begin{array}{l} \exists x \in \{a\}.\exists y \in \{c\}.\phi \\ \exists x \in \{a\}.\exists y \in \{d\}.\phi \end{array} \subset \exists x \in \{a\}.\exists y \in \{c,d\}.\phi$$

$$\begin{array}{l} \exists x \in \{b\}.\exists y \in \{c\}.\phi \\ \exists x \in \{b\}.\exists y \in \{d\}.\phi \end{array} \subset \exists x \in \{b\}.\exists y \in \{c,d\}.\phi$$

$$\begin{array}{l} \exists x \in \{a\}.\exists y \in \{c\}.\phi \\ \exists x \in \{b\}.\exists y \in \{c\}.\phi \end{array} \subset \exists x \in \{a,b\}.\exists y \in \{c\}.\phi$$

$$\begin{array}{l} \exists x \in \{a\}.\exists y \in \{d\}.\phi \\ \exists x \in \{b\}.\exists y \in \{d\}.\phi \end{array} \subset \exists x \in \{a,b\}.\exists y \in \{d\}.\phi$$

$$\subset \exists x \in \{a,b\}.\exists y \in \{c,d\}.\phi$$

For the Q-operator, I assume the entry in (51). It takes two arguments: A proposition p and the set of alternatives of p. It returns a set of propositions, namely that set that includes those propositions that are singleton domain members of $Alt(p)$. Moreover, it is required that when all the members in the resulting set are disjoined, the outcome is equivalent to p (subscripted SD indicates that the proposition is a singleton domain alternative).

(51) $[\![\mathrm{Q}]\!]^g(Alt(p)_{\langle\langle st\rangle t\rangle})(p_{\langle st\rangle}) = \{q : q \in Alt(p) \wedge q_{SD}\}$, where the disjunction of all propositions $\in \{q : q \in Alt(p) \wedge q_{SD}\} = p$

What does this mean for the example (48)? Q takes all the singleton domain alternatives in (50) such that when disjoined the result is equivalent to the ordinary value of CP. It turns out that all the singleton domain alternatives in (50) will be in the denotation of the question. To see this, notice that the proposition with the largest domains (52a) is equivalent to the disjunctive statement in (52b). In other words, it is equivalent to the disjunction of all propositions with singleton domains. This means that the alternatives considered are ordered under disjunction. The same must thus hold for our actual example.

(52) a. $\exists x \in \{a,b\}.\exists y \in \{c,d\}.\phi$

b. $\exists x \in \{a\}.\exists y \in \{c\}.\phi \vee \exists x \in \{a\}.\exists y \in \{d\}.\phi \vee \exists x \in \{b\}.\exists y \in \{c\}.\phi \vee \exists x \in \{b\}.\exists y \in \{d\}.\phi$

But this means that the denotation of the question is as in (53), which is just the Hamblin/Karttunen question denotation.

(53) $\{p : \exists x.\exists y[p = \lambda w.introduce_w(Hans, x, y)]\}$

This means that our system derives the correct interpretation for the multiple wh-example discussed. Moreover we have seen that the alternatives used are ordered by disjunction. All of this is straightforwardly applicable to single wh-questions. In the following section, I will turn to the explanation of intervention effects. But before doing so, let me briefly comment on why the disjunction requirement on the alternatives in the question denotation in (51) should hold.

4.4.3 Why disjunction?

In the preceding section it was already noted that asking a question means that one is seeking information as to which member of a set of propositions is true. This means that one wants to know whether p or whether q is true if p and q are the only two members of a given question denotation. The propositions are therefore naturally ordered by disjunction. In other words, the members of a question denotation must be ordered under disjunction. This seems intuitive.

But why must the disjunction of all propositions in the question denotation be equivalent to the ordinary value of the CP-constituent? One can think of this value as already containing all the information that is required for asking a question. Thus, the ordinary value of CP reflects the information status of the speaker. For all the speaker knows any of the disjuncts making up the ordinary value of the CP could be true. Therefore, what a speaker does when she utters a question is to give the answerer information as to which domain of answers she is interested in – that is, the propositions corresponding to the disjuncts of the ordinary value of CP. The Q-operator now does nothing more than to extract all the singleton domain propositions that can count as answers from the ordinary value of CP. What would happen if the propositions in the question denotation were not ordered under disjunction and the requirement that they are ordered, as proposed, were absent from the lexical entry of Q? This would have the consequence

that the propositions in the question denotation – and therefore also the possible answers to the question – would necessarily not be included in the domain of answers that the speaker is interested in. If the ordinary value of CP reflects that domain and the disjunction of the propositions in the question denotation does not return this domain, then the possible answers do not provide information (or at least not directly) to the issue that the speaker is interested in. But this has the consequence that the propositions in $[\![\text{CP}]\!]^{Alt}$ must already be ordered by disjunction. It will be seen that intervention effects arise exactly in situations where this is not the case.

Lastly, why are the other propositions in the alternative value of CP irrelevant, i.e., why can they not be members of the question denotation? In certain situations, a proposition with a bigger domain might also count as an answer to a question. In particular, the proposition denoted by *John met Mary or Sue* might be an answer to the question *Who did John meet?* if all the answerer knows is that John met Mary or Sue, but she does not know whether John met both of them. In this particular situation, the denotation of the sentence under discussion corresponds to the most informative answer to the question. This means that one cannot simply claim that the Q-operator is only interested in the singleton domain alternatives because these are the only possible answers to a question. I suspect that it is the singleton domain alternatives that the Q-operator extracts because these allow questions denotations with the strongest alternatives possible, but moreover weaker answers can be reconstructed from them by disjunction.

In the following section, I turn to the explanation of intervention effects. It is shown that they are straightforwardly accounted for by the approach argued for in the present section. As will be seen, the disjunction requirement is not fulfilled in constructions exhibiting intervention effects. That is, such questions denote the empty set.

4.5 Deriving intervention effects

In the present section, I show that intervention effects arise if the following holds:

(54) *Intervention effects generalization*

A wh-question shows an intervention effect if it denotes the empty set.

When is the question denotation empty according to the theory outlined in the previous section? The question denotation is empty if the disjunction of all the singleton domain propositions in the alternative value of the sister constituent of Q is not equivalent to the ordinary value of the latter – that is, the ordinary value of CP. In less abstract terms, the question operator Q returns the empty set if the alternatives to the denotation of its sister are not order by disjunction, as described above. Recall that the empty set denotation is the consequence of answers that do not reflect what the speaker asking the question is interested in. Questions with such denotations simply cannot be asked. I will first show how the analysis works abstractly with negation. Then I turn to actual German multiple wh-questions with intervening negation and universal quantifiers.

4.5.1 Abstract intervention effects

Let us compare the LFs in (55). In (55a) the wh-expression takes scope below the negative quantifier, whereas in (55b) it takes scope above the quantifier. (55a), on the one hand, can be taken as the LF for a wh-in-situ question under the present approach. It would of course not constitute a grammatical wh-question in German because wh-in-situ is only allowed when overt wh-movement has occurred. Nevertheless the central point of this section can be made with (55a). (55b), on the other hand, can be seen as the representation of a wh-question with overt wh-movement to Spec,CP. I will now show that our approach predicts an empty denotation for (55a), but a non-empty one for (55b).

(55) a. Q [$_{CP}$ no one 2[who 1[t_2 invited t_1]]]

b. Q [$_{CP}$ who 1[no one 2[t_2 invited t_1]]]

Let us start with (55a). The ordinary and alternative values for CP are as in (56a) and (56b), respectively. Note that the domain for the existential quantifier representing the wh-expression

assumed in the ordinary value is $\{a, b, c\}$. Therefore the domain alternatives in (56b) must be subsets of this domain.

(56) a. $[\![\text{CP}]\!]^g = \lambda w.\neg\exists x.\exists y \in \{a, b, c\}[invite_w(x, y)]$

b. $[\![\text{CP}]\!]^{Alt} = \{\lambda w.\neg\exists x.\exists y \in D'[invite_w(x, y)] \mid \emptyset \neq D' \subseteq \{a, b, c\}\}$

Remember that for the multiple wh-question (48) discussed in the previous section we noted that the singleton domain alternatives in the alternative value for CP are the strictly strongest propositions. This would of course not change if there were only one wh-expression involved. In the present case, however, the wh-element is in the scope of a negative quantifier. We already noted that these are DE on both arguments. Since DE-environments flip the entailment relations, the entailments among the propositions in the alternative value switch as well. The proposition with the largest domain is now the strictly strongest one. It asymmetrically entails all other alternatives. To see this, note that if no one invited anyone from the domain $\{a, b, c\}$, then it must be the case that no one invited anyone from the domain $\{a, b\}$, and so on. The asymmetric entailment relations are visualized in (57).

(57)
$$\neg\exists x.\exists y \in D_{\{a,b,c\}}.\phi \subset \begin{cases} \neg\exists x.\exists y \in D_{\{a,b\}}.\phi \subset \begin{cases} \neg\exists x.\exists y \in D_{\{a\}}.\phi \\ \neg\exists x.\exists y \in D_{\{b\}}.\phi \end{cases} \\ \neg\exists x.\exists y \in D_{\{a,c\}}.\phi \subset \begin{cases} \neg\exists x.\exists y \in D_{\{a\}}.\phi \\ \neg\exists x.\exists y \in D_{\{c\}}.\phi \end{cases} \\ \neg\exists x.\exists y \in D_{\{b,c\}}.\phi \subset \begin{cases} \neg\exists x.\exists y \in D_{\{b\}}.\phi \\ \neg\exists x.\exists y \in D_{\{c\}}.\phi \end{cases} \end{cases}$$

According to the theory proposed, the question denotation should include as members all singleton domain propositions in (57) if the disjunction of those propositions is equivalent to the ordinary value of CP. However, the propositions are not ordered in the way required, because the entailments are reversed. If the propositions under discussion were ordered as required, then the disjunction of the singleton domain alternatives with a and b as the respective domains should

be equivalent to the alternative where the domain is $\{a, b\}$. This is, however, not the case, (58); the disjunction of the singleton domain alternatives can be paraphrased as 'No one invited *a* or no one invited *b*'. The alternative with the bigger domain can be paraphrased as 'For everyone it is not the case that he invited *a* or *b*'. It is now easy to see that the non-equivalence in (58) holds. Adding the third singleton domain alternative to the disjunction therefore does not return the denotation of CP either.

(58) $\neg\exists x.\exists y \in D_{\{a\}}.\phi \vee \neg\exists x.\exists y \in D_{\{b\}}.\phi \neq \neg\exists x.\exists y \in D_{\{a,b\}}.\phi$

What does all this mean for the semantics for wh-questions proposed in the previous section? Since there are no propositions in $[\![\text{CP}]\!]^{Alt}$ that would qualify as members of the question denotation (none of the singleton domain alternatives is such that by disjoining it with another singleton domain alternative the denotation of CP results), it follows that the question corresponding to the LF in (55a) denotes the empty set. Remember what this means under the present assumptions: The propositions in $[\![\text{CP}]\!]^{Alt}$ – and therefore by extension the possible answers to the question – do not correspond to answers to the question that the speaker who utters (55a) is interested in. This results in an empty question denotation. It is natural to assume that this leads to an uninterpretability.

Let us now turn to the LF (55b) where the wh-expression has scope over the negative quantifier. The ordinary and the alternative values for the CP-constituent change accordingly:

(59) a. $[\![\text{CP}]\!]^{g} = \lambda w.\exists y \in \{a, b, c\}.\neg\exists x.[invite_w(x, y)]$

b. $[\![\text{CP}]\!]^{Alt} = \{\lambda w.\exists y \in D'.\neg\exists x.[invite_w(x, y)] \mid \emptyset \neq D' \subseteq \{a, b, c\}\}$

Since the existential quantifier denoted by the wh-expression now has scope over the negative quantifier, it is not in a DE-environment anymore. Therefore the entailment pattern from (57) above is reversed to (60). The propositions with the smallest domains entail all other propositions.

(60)
$$\begin{array}{l} \exists y \in D_{\{a\}}.\neg\exists x.\phi \\ \exists y \in D_{\{b\}}.\neg\exists x.\phi \end{array} \subset \exists y \in D_{\{a,b\}}.\neg\exists x.\phi$$

$$\begin{array}{l} \exists y \in D_{\{a\}}.\neg\exists x.\phi \\ \exists y \in D_{\{c\}}.\neg\exists x.\phi \end{array} \subset \exists y \in D_{\{a,c\}}.\neg\exists x.\phi \quad \subset \exists y \in D_{\{a,b,c\}}.\neg\exists x.\phi$$

$$\begin{array}{l} \exists y \in D_{\{b\}}.\neg\exists x.\phi \\ \exists y \in D_{\{c\}}.\neg\exists x.\phi \end{array} \subset \exists y \in D_{\{b,c\}}.\neg\exists x.\phi$$

Are the propositions in (60) ordered by disjunction as required by the present approach? Notice first of all that $\lambda w.\exists y \in D_{\{a,b,c\}}.\neg\exists x[invite_w(y, x)]$ can be paraphrased as the disjunctive statement 'No one invited a or no one invited b or no one invited c'. It thus follows that disjoining the singleton domain alternatives – the result of which is the same as in the previous example – in (61) is equivalent to the alternative with the largest domain.

(61) $\exists y \in D_{\{a\}}.\neg\exists x.\phi \vee \exists y \in D_{\{b\}}.\neg\exists x.\phi \vee \exists y \in D_{\{c\}}.\neg\exists x.\phi = \exists y \in D_{\{a,b,c\}}.\neg\exists x.\phi$

The Q-operator therefore returns as question denotation the value in (62). Thus, we see that the Hamblin/Karttunen denotation is returned by the Q-operator if the wh-expression has scope over the negative quantifier. It is easy to see that this result generalizes to other cases of intervening negation. We will return to this issue in the following section.

(62) $[\![(55b)]\!]^g = \{p : \exists y[p = w.\neg\exists x[invite_w(x, y)]]\}$

To summarize, the present account draws a line between an LF where a negative quantifier has scope over a wh-expression and one where the wh-expression has scope over the quantifier. Only the latter has a non-empty denotation. Moreover, the latter has as its denotation the Hamblin/Karttunen denotation.

4.5.2 Multiple wh-questions

In this subsection I show that the explanation argued for here generalizes to multiple wh-questions with intervening negation and universal quantifiers.

4.5.2.1 Negation in multiple wh-questions

It is fairly easy to see that the account from the preceding subsection immediately carries over to multiple wh-questions with an intervening negative quantifier. If the alternatives of the CP-constituent in (55a) are not ordered by disjunction because of the DE-operator, this also cannot be the case for multiple wh-questions where the wh-in-situ expression is in a DE-environment, irrespective of the fact that the higher wh-expression is not in a DE-environment. In general, whenever there is a negation intervening between a wh-in-situ and further wh-expressions, not all propositions in the alternative value of CP can be ordered by disjunction in the way required in the present proposal. In particular, the disjunction of all singleton domain alternatives is not equivalent to the ordinary value of CP. This can be easily seen by the statement in (63), where it is assumed that the singleton domain propositions and the alternative with the two-member domain for the in-situ wh-expression are all the relevant alternatives. If the singleton domain alternatives were ordered under disjunction, the left and the right side in (63) should be equivalent. This is so, because, as we have seen already, disjunction of two alternatives should always take us back to an alternative with a bigger domain. Since the non-equivalence in (63) holds in general when a DE-element intervenes, it follows that intervention effects are predicted for multiple wh-questions in the same way as for single-wh questions.

(63) $\exists x \in \{a\}.\neg\exists y \in \{c\}.\phi \vee \exists x \in \{a\}.\neg\exists y \in \{d\}.\phi \neq \exists x \in \{a\}.\neg\exists y \in \{c, d\}.\phi$

Recall now the difference between (64a) and (64b), repeated from above.

(64) a. *Wen hat niemand wem vorgestellt?
who has no one whom introduced

b. Wen hat wem niemand vorgestellt?
who has whom no one introduced
'Who did no one introduce to whom?'

The LFs corresponding to (64a) and (64b) are (65a) and (65b), respectively:

(65) a. Q [$_{CP}$ wen 1[hat niemand 2[wem 3[t_2 t_3 t_1 vorgestellt]]]]

b. Q [$_{CP}$ wen 1[hat wem 3[niemand 2[t_2 t_3 t_1 vorgestellt]]]]

The ordinary and alternative values for (65a) are given in (66). Here we assume again that both wh-expressions introduce a two-membered domain. Note that we further assume that they do not overlap. Nothing hinges on this particular choice, but it makes exposition easier.

(66) a. $[\![\text{CP}]\!]^g = \lambda w.\exists x \in \{a,b\}.\neg\exists y.\exists z \in \{c,d\}[introduce_w(y,x,z)]$

b. $[\![\text{CP}]\!]^{Alt} = \{\lambda w.\exists x \in D.\neg\exists y.\exists z \in D'[introduce_w(y,x,z)] \mid \emptyset \neq D \subseteq \{a,b\}, \emptyset \neq D' \subseteq \{c,d\}\}$

The entailment relations between the members of the alternative value of CP are more complicated than before. It should, however, be clear that the two propositions with domain D being a singleton domain and D' being a two-membered domain are the strongest alternatives. This is so because the first wh-expression, on the one hand, is in an UE-environment. Because of this the singleton domains are the strongest ones. The second wh-expression, on the other hand, is in a DE-environment. Therefore the largest domains are the strongest ones. In other words, $\lambda w.\exists x \in D_{\{a\}}.\neg\exists y.\exists z \in D'_{\{c,d\}}[introduce_w(y,x,z)]$ and $\lambda w.\exists x \in D_{\{b\}}.\neg\exists y.\exists z \in D'_{\{c,d\}}[introduce_w(y,x,z)]$ are the strongest alternatives.[11] We now note that the propositions in the alternative value are not ordered by disjunction, as before. Consider the singleton domain alternatives in (67). Their

[11]The complete entailments are given in (i). Due to the reversed nature of the entailments, the entailments concerning the singleton domain alternatives for the wh-in-situ expression are plotted separately.

(i) a. $\exists x \in D_{\{a\}}.\neg\exists y.\exists z \in D'_{\{c,d\}}.\phi \subset \begin{matrix}\exists x \in D_{\{a\}}.\neg\exists y.\exists z \in D'_{\{c\}}.\phi \\ \exists x \in D_{\{a,b\}}.\neg\exists y.\exists z \in D'_{\{c,d\}}.\phi\end{matrix}$

$\exists x \in D_{\{b\}}.\neg\exists y.\exists z \in D'_{\{c,d\}}.\phi \subset \begin{matrix}\exists x \in D_{\{b\}}.\neg\exists y.\exists z \in D'_{\{c\}}.\phi \\ \exists x \in D_{\{a,b\}}.\neg\exists y.\exists z \in D'_{\{c,d\}}.\phi\end{matrix}$

$\subset \exists x \in D_{\{a,b\}}.\neg\exists y.\exists z \in D'_{\{c\}}.\phi$

disjunction can be paraphrased as 'As for a no one introduced him to c or no one introduced him to d'. This is not equivalent to the alternative with the domain $\{c, d\}$ for D', which says that 'As for a no one introduced him c or d'. But if the alternatives were ordered under disjunction, equivalence should hold. Therefore adding the remaining singleton domain alternatives will not return the ordinary value of CP. The disjunction of the remaining two singleton domain propositions can be paraphrased as 'As for b no one introduced him to c or no one introduced him to d'. But since the singleton domain alternatives are not ordered under disjunction, as required, the question denotation is the empty set. In other words, an intervention effect is predicted.

(67) $\exists x \in D_{\{a\}}.\neg\exists y.\exists z \in D'_{\{c\}}.\phi \vee \exists x \in D_{\{a\}}.\neg\exists y.\exists z \in D'_{\{d\}}.\phi \neq \exists x \in D_{\{a\}}.\neg\exists y.\exists z \in D'_{\{c,d\}}.\phi$

When both wh-expressions have scope over the negative quantifier (65a), the entailments among the alternatives change. Now the singleton domain alternatives are the strongest propositions in the alternative value because none of the wh-expressions is in a DE-environment.[12] The alternatives are ordered under disjunction. The disjunction of the singleton domain alternatives in (68) can be paraphrased as 'No one introduced a to c or no one introduced a to d'. This is equivalent to the alternative with $\{c, d\}$ as the domain for the lower wh-expression. Adding the disjunction of the remaining singleton domain alternatives results in the proposition paraphrasable as 'No one introduced a to c or non introduced a to d or no one introduced b to c or no one introduced b to d.' This is equivalent to the ordinary value of CP.

b. $$\begin{array}{l}\exists x \in D_{\{a\}}.\neg\exists y.\exists z \in D'_{\{c,d\}}.\phi \subset \begin{array}{l}\exists x \in D_{\{a\}}.\neg\exists y.\exists z \in D'_{\{d\}}.\phi \\ \exists x \in D_{\{a,b\}}.\neg\exists y.\exists z \in D'_{\{c,d\}}.\phi\end{array} \\ \exists x \in D_{\{b\}}.\neg\exists y.\exists z \in D'_{\{c,d\}}.\phi \subset \begin{array}{l}\exists x \in D_{\{b\}}.\neg\exists y.\exists z \in D'_{\{d\}}.\phi \\ \exists x \in D_{\{a,b\}}.\neg\exists y.\exists z \in D'_{\{c,d\}}.\phi\end{array}\end{array} \subset \exists x \in D_{\{a,b\}}.\neg\exists y.\exists z \in D'_{\{d\}}.\phi$$

[12] The entailments are as in (i):

(i) $$\begin{array}{l}\exists x \in D_{\{a\}}.\exists z \in D'_{\{c\}}.\neg\exists y.\phi \\ \exists x \in D_{\{a\}}.\exists z \in D'_{\{d\}}.\neg\exists y.\phi\end{array} \subset \exists x \in D_{\{a\}}.\exists z \in D'_{\{c,d\}}.\neg\exists y.\phi$$
$$\begin{array}{l}\exists x \in D_{\{b\}}.\exists z \in D'_{\{c\}}.\neg\exists y.\phi \\ \exists x \in D_{\{b\}}.\exists z \in D'_{\{d\}}.\neg\exists y.\phi\end{array} \subset \exists x \in D_{\{b\}}.\exists z \in D'_{\{c,d\}}.\neg\exists y.\phi$$
$$\begin{array}{l}\exists x \in D_{\{a\}}.\exists z \in D'_{\{c\}}.\neg\exists y.\phi \\ \exists x \in D_{\{b\}}.\exists z \in D'_{\{c\}}.\neg\exists y.\phi\end{array} \subset \exists x \in D_{\{a,b\}}.\exists z \in D'_{\{c\}}.\neg\exists y.\phi \quad \subset \exists x \in D_{\{a,b\}}.\exists z \in D'_{\{c,d\}}.\neg\exists y.\phi$$
$$\begin{array}{l}\exists x \in D_{\{a\}}.\exists z \in D'_{\{d\}}.\neg\exists y.\phi \\ \exists x \in D_{\{b\}}.\exists z \in D'_{\{d\}}.\neg\exists y.\phi\end{array} \subset \exists x \in D_{\{a,b\}}.\exists z \in D'_{\{d\}}.\neg\exists y.\phi$$

(68) $\exists x \in D_{\{a\}}.\exists z \in D'_{\{c\}}.\neg\exists y.\phi \vee \exists x \in D_{\{a\}}.\exists z \in D'_{\{d\}}.\neg\exists y.\phi = \exists x \in D_{\{a\}}.\exists z \in D'_{\{c,d\}}.\neg\exists y.\phi$

The value of the question is the set containing only the singleton domain alternatives from the alternative value of CP. As already seen before, this is equivalent to the Hamblin/Karttunen denotation given in (69). I.e., the present account derives the correct meaning for the question in (65a).

(69) $[\![(65a)]\!]^g = \{p : \exists x.\exists z[p = \lambda w.\neg\exists y[introduce_w(y, x, z)]]\}$

4.5.2.2 Universal quantification in multiple wh-questions

Recall the difference between the question in (70) and the one in (71), repeated from above. The former only has the distributive interpretation in (70a) for which we assumed that the universal quantifier takes scope above the Q-operator. But it does not have the single-pair interpretation in (70b). (71), on the other hand, has both interpretations. Following Beck (1996a) we attributed this difference to the intervening universal quantifier in (70) which is absent in (71). These facts were taken to suggest that it would be incorrect to directly blame DE-environments for intervention effects, as universal quantifiers are not DE on their second argument.

(70) Wen hat jeder Junge wann beobachtet?
who has every boy when observed
a. 'For every boy, who did he observe when?'
b. *Who is such that every boy observed him when?'

(71) Wen hat wann jeder Junge beobachtet?
who has when every boy observed
a. 'For every boy, who did he observe when?'
b. Who is such that every boy observed him when?'

The present approach predicts the difference in interpretation between (70) and (71). Assume the LFs in (72a) and (72b) for the single-pair interpretation of (70) and (71), respectively.

(72) a. Q [$_{CP}$ wen 1[hat jeder Junge 2[t_2 wann 3[t_3 t_1 beobachtet]]]

b. Q [$_{CP}$ wen 1[hat wann 2[jeder Junge t_2 t_1 beobachtet]]]

The ordinary and alternative values for (72a) are given in (73), again assuming two non-overlapping two-member domains.

(73) a. $[\![\text{CP}]\!]^g = \lambda w.\exists x \in \{a,b\}.\forall y.\exists z \in \{c,d\}[watch_w(y,x,z)]$

b. $[\![\text{CP}]\!]^{Alt} = \{\lambda w.\exists x \in D.\forall y.\exists z \in D'[watch_w(y,x,z)] \mid \emptyset \neq D \subseteq \{a,b\}, \emptyset \neq D' \subseteq \{c,d\}\}$

We note that the entailment patterns for the propositions in (73b) are such that the singleton domain alternatives are the strongest propositions. If it is the case that every boy watched a at c or d, then it follows that every boy watched a at c or d or that he watched b at c or d. I.e., the proposition with one singleton domain and one two-membered domain entails the alternative with only two-membered domains. Note in particular that since the existential quantifier introduced by the wh-in-situ expression is in the scope of the universal quantifier, it follows that we get a distributive reading. In other words, considering the alternative with $\{a\}$ and $\{c,d\}$ as domains again, we get a reading where for each boy there is a time in $\{c,d\}$ such that he invited a. This will prove to be crucial.

(74)
$$\begin{array}{l} \exists x \in D_{\{a\}}.\forall y.\exists z \in D'_{\{c\}}.\phi \\ \exists x \in D_{\{a\}}.\forall y.\exists z \in D'_{\{d\}}.\phi \end{array} \subset \exists x \in D_{\{a\}}.\forall y.\exists z \in D'_{\{c,d\}}.\phi$$

$$\begin{array}{l} \exists x \in D_{\{b\}}.\forall y.\exists z \in D'_{\{c\}}.\phi \\ \exists x \in D_{\{b\}}.\forall y.\exists z \in D'_{\{d\}}.\phi \end{array} \subset \exists x \in D_{\{b\}}.\forall y.\exists z \in D'_{\{c,d\}}.\phi$$

$$\begin{array}{l} \exists x \in D_{\{a\}}.\forall y.\exists z \in D'_{\{c\}}.\phi \\ \exists x \in D_{\{b\}}.\forall y.\exists z \in D'_{\{c\}}.\phi \end{array} \subset \exists x \in D_{\{a,b\}}.\forall y.\exists z \in D'_{\{c\}}.\phi$$

$$\begin{array}{l} \exists x \in D_{\{a\}}.\forall y.\exists z \in D'_{\{d\}}.\phi \\ \exists x \in D_{\{b\}}.\forall y.\exists z \in D'_{\{d\}}.\phi \end{array} \subset \exists x \in D_{\{a,b\}}.\forall y.\exists z \in D'_{\{d\}}.\phi$$

$$\subset \begin{array}{l} \exists x \in D_{\{a,b\}}.\forall y. \\ \exists z \in D'_{\{c,d\}}.\phi \end{array}$$

The fact that the embedded existential quantifier is distributed over by the universal quantifier has the consequence that the alternatives in (74) are not ordered by disjunction. Consider disjoining the singleton domain alternatives in (75) which does not return a member of (74). In particular, it does not return the alternative where domain D' is set to $\{c, d\}$, as would be required if the alternatives were ordered by disjunction. The left side of the non-equivalence statement in (75) can be paraphrased as 'Every boy watched a at c or every boy watched a at d'. The right side, however, says that every boy watched a at c or d – that is, the universal quantifier distributes over the times c and d. The latter statement is not equivalent to the former disjunctive statement. This means that there is simply no way to get the ordinary value of CP back from the disjunction of the propositions in the alternative value of CP when we add the remaining singleton domain alternatives to the disjunction on the left side in (75). The consequence of this is that the wh-question denotes the empty set.

(75) $\exists x \in D_{\{a\}}.\forall y.\exists z \in D'_{\{c\}}.\phi \vee \exists x \in D_{\{a\}}.\forall y.\exists z \in D'_{\{d\}}.\phi \neq \exists x \in D_{\{a\}}.\forall y.\exists z \in D'_{\{c,d\}}.\phi$

When we turn to the scrambling example with the LF (72b), the ordinary and alternative values for CP become as in (76).

(76) a. $[\![\text{CP}]\!]^g = \lambda w.\exists x \in \{a, b\}.\exists z \in \{c, d\}.\forall y[watch_w(y, x, z)]$

b. $[\![\text{CP}]\!]^{Alt} = \{\lambda w.\exists x \in D.\exists z \in D'.\forall y[watch_w(y, x, z)] \mid \emptyset \neq D \subseteq \{a, b\}, \emptyset \neq D' \subseteq \{c, d\}\}$

Again, the alternatives are ordered by entailment in such a way that the singleton domain alternatives are the strongest. This time, however, the distributive reading is unavailable because both wh-expressions have scope over the universal quantifier.

(77)
$$\begin{array}{l} \exists x \in D_{\{a\}}.\exists z \in D'_{\{c\}}.\forall y.\phi \\ \exists x \in D_{\{a\}}.\exists z \in D'_{\{d\}}.\forall y.\phi \end{array} \subset \exists x \in D_{\{a\}}.\exists z \in D'_{\{c,d\}}.\forall y.\phi$$

$$\begin{array}{l} \exists x \in D_{\{b\}}.\exists z \in D'_{\{c\}}.\forall y.\phi \\ \exists x \in D_{\{b\}}.\exists z \in D'_{\{d\}}.\forall y.\phi \end{array} \subset \exists x \in D_{\{b\}}.\exists z \in D'_{\{c,d\}}.\forall y.\phi$$

$$\begin{array}{l} \exists x \in D_{\{a\}}.\exists z \in D'_{\{c\}}.\forall y.\phi \\ \exists x \in D_{\{b\}}.\exists z \in D'_{\{c\}}.\forall y.\phi \end{array} \subset \exists x \in D_{\{a,b\}}.\exists z \in D'_{\{c\}}.\forall y.\phi$$

$$\begin{array}{l} \exists x \in D_{\{a\}}.\exists z \in D'_{\{d\}}.\forall y.\phi \\ \exists x \in D_{\{b\}}.\exists z \in D'_{\{d\}}.\forall y.\phi \end{array} \subset \exists x \in D_{\{a,b\}}.\exists z \in D'_{\{d\}}.\forall y.\phi$$

$$\subset \begin{array}{c} \exists x \in D_{\{a,b\}}. \\ \exists z \in D'_{\{c,d\}}.\forall y.\phi \end{array}$$

With the distributive reading gone, the alternatives are ordered by disjunction in the way required by our theory. The member proposition on the right side in (78) can be paraphrased as 'every boy watched *a* at *c* or every boy watched *a* at *d*'. But this is, obviously, equivalent to the disjunction the left side. The equivalence in (78) is evidence of the fact that disjoining the singleton domain propositions in the alternative value of CP returns the ordinary value of CP because disjunction of two alternatives always returns another member of that set.

(78) $\exists x \in D_{\{a\}}.\exists z \in D'_{\{c\}}.\forall y.\phi \vee \exists x \in D_{\{a\}}.\exists z \in D'_{\{d\}}.\forall y.\phi = \exists x \in D_{\{a\}}.\exists z \in D'_{\{c,d\}}.\forall y.\phi$

Since the singleton domain alternatives are ordered by disjunction they also form the question denotation. This, again, is equivalent to the Hamblin/Karttunen denotation in (79).

(79) $[\![(72b)]\!]^g = \{p : \exists x.\exists z[p = \lambda w.\forall y[watch_w(y, x, z)]\}$

The present approach correctly predicts intervention effects for structures like (72a) and acceptability of structures like (72b). As with intervening negation, the result of this subsection generalizes. In all cases where a wh-expression takes scope below a universal quantifier, a distributive reading for the meaning of the CP-constituent is the consequence. In this case, the alternatives will therefore never be ordered by disjunction and the question denotes the empty set. Only when the wh-expressions take scope above the universal quantifier, will a non-empty

denotation result.[13]

4.5.3 Syntactic considerations

We are now in a position to address the question why scrambling is allowed in constructions where an intervention effect would arise otherwise. Remember our assumption that syntax provides competitor representations for a given construction. For the questions in (80), we are interested in the representations in (81).

(80) a. *Wen hat niemand wem vorgestellt?
who has no one whom introduced

b. Wen hat wem niemand vorgestellt?
who has whom no one introduced
'Who did no one introduce to whom?'

(81) a. Q [$_{CP}$ wen$_{[Q]}$ 1 [$_{C'}$ hat niemand wem$_{[Q]}$ t_1 vorgestellt]]

b. Q [$_{CP}$ wen$_{[Q]}$ 1 [$_{C'}$ hat wem$_{[Q]}$ 2[niemand $t_{2,overt}$ t_1 vorgestellt]]]

c. Q [$_{CP}$ wen$_{[Q]}$ 1 [$_{C'}$ hat niemand 3[wem$_{[Q]}$ 2[t_3 $t_{2,covert}$ t_1 vorgestellt]]]]

d. Q [$_{CP}$ wen$_{[Q]}$ 1 [$_{C'}$ hat wem$_{[Q]}$ 2[niemand $t_{2,covert}$ t_1 vorgestellt]]]

Recall furthermore our assumptions regarding economy from subsection 4.4.1: If a converging structure without movement can be achieved, it is to be preferred. Moreover, overt movement is more economical than covert movement, as the latter is subject to scope economy (Fox 2000). Wh-expressions are existential quantifiers and therefore must undergo obligatory QR when in object position. Only in the specific case where a quantificational object cannot be interpreted in its base position, covert movement is not subject to scope economy. This allowed us to account for multiple wh-questions without semantic intervener. Here the wh-in-situ expression must raise in order to be interpretable. Since this QR is forced, overt movement is not necessary.

[13]Note that no intervention effects are predicted for (70) under the distributive interpretation. The reason is that we assumed following Beck (1996a) (herself following Chierchia (1992), Groenendijk and Stokhof (1984), and Higginbotham (1993) a.o.) that in this case the universal quantifier scopes over the whole question. If this is correct, then it follows that the alternative value for the CP-constituent only contains the existential quantifiers introduced by the wh-expressions. But as we already know these values behave just like normal multiple wh-questions without any intervener. It therefore follows under the present theory that (70) is not unacceptable as such but only unambiguous.

This accounts for the correct word order.

In the case of (80), however, things are different. We already know that representation (81a) is non-converging. The reason is that the existential quantifier corresponding to the wh-in-situ expression is not interpretable in-situ. As a consequence, (81a) is correctly ruled out by our theory. Representation (81c) with obligatory QR of the wh-in-situ expression below the scope of the negation results in an empty denotation, i.e., it is uninterpretable and therefore blocked as well. This means that only (81b) and (81d) are possible competitors not ruled out by the threat of an intervention effect. Note, however, that the the latter involves an instance of QR that is not obligatory. It is not necessary for the wh-in-situ to QR over the intervening negative quantifier for simple type reasons. I.e., this type of QR is subject to scope economy. We said that in such situations overt movement is generally preferred, if available at all. In German scrambling makes overt movement an option. Therefore it is predicted that only representation (81b) converges. In other words, only the question in (80b) corresponds to an interpretable question in German.

This makes a further prediction: In languages where overt movement for wh-expressions other than fronting to Spec,CP is not an option – that is, where scrambling is prohibited –, the representation corresponding to (81d) should be converging. In other words, English, which is said to not exhibit intervention effects (82), in fact is predicted by the present approach to have intervention effects, as well. But since the representation involving non-obligatory QR is not blocked by a competing scrambling interpretation, these do not surface, and it seems that English is a language without intervention effect. In yet other words, the present proposal makes the strong prediction that intervention effects of the type discussed in this chapter are more or less universal.[14]

(82) a. Who did no one introduce to who?

b. *Who did to who no one introduce?

[14]Intervention effects are not completely absent from English. Cf. the observations by Pesetsky (2000). Moreover, some languages treat some quantifiers as interveners but not others (cf. Kim (2002) and Beck (2006)). Both problems are addressed in subsection 4.6.3 below.

In the following section I turn to the predictions of the present proposal.

4.6 Predictions of the analysis

The results from the last section are what we hoped for. It has become increasingly clear that the unifying semantic trait of the interveners under discussion is that they have the effect on disjunction argued for – that is, the disjunction of the propositions in the question denotation must yield the ordinary value of CP. As hypothesized in section 4.3 above, intervention effects are really about the mutual scope between intervening elements and disjunction. This scope relation is characterized in the present account by the scope relation between certain semantic operators and existential quantifiers denoted by wh-expressions, as the latter introduce disjunction through the domain alternatives that they activate. In other words, the initial hypothesis is confirmed by this analysis. Recall that above I noted that focus operators behave similarly with respect to their scope relative to disjunction, whereas UE-existential quantifiers show a different pattern. This also means that the present theory predicts intervention effects for the former but not for the latter cases. In the following two subsections I turn to these predictions. In subsection 4.6.3, I discuss some important cross-linguistic considerations.

4.6.1 Intervening UE- vs. DE-indefinites

First recall the data in (83), repeated from above, which exemplify the difference between UE- and DE-indefinites with respect to intervention effects. Only the construction with a DE-intervener (83b) exhibits uninterpretability. Also recall our observation that the slight degradedness of examples like (83a) vanishes if the context is chosen in such a way as to make it unlikely that a negative scalar implicature is generated for the UE-indefinite.

(83) a. ?Wen haben mindestens zwei Studenten wem vorgestellt?
who have at least two students whom introduced
'Who did at least two students introduce to who?'

b. *Wen haben höchstens zwei Studenten wem vorgestellt?
who have at most two students whom introduced

This pattern is directly predicted by the present approach. Remember that we said in section 4.3 that UE- and DE-indefinites can be likened to existential quantifiers ranging over their witness sets.

Consider first the ordinary and the alternative value for the CP-constituent of (83a), assuming an LF where the wh-in-situ takes scope below the UE-indefinite. Since the UE-indefinite can be represented as an existential quantifier ranging over its witness set, it should already be clear that no intervention effect is predicted by the present account. The indefinite should behave like another wh-expression in that respect which also does not cause intervention effects.[15]

(84) a. $[\![\text{CP}]\!]^g = \lambda w.\exists x \in \{a, b\}.\exists y[\geq 2\ \mathit{student}_w(y) \wedge \exists z \in \{c, d\}[\mathit{introduce}_w(y, x, z)]]$

b. $[\![\text{CP}]\!]^{Alt} = \{\lambda w.\exists x \in D.\exists y[\geq 2\ \mathit{student}_w(y) \wedge \exists z \in D'[\mathit{invite}_w(y, x, z)]] \mid \emptyset \neq D \subseteq \{a, b\}, \emptyset \neq D' \subseteq \{c, d\}\}$

Since no entailment reversal occurs, it is predicted that the singleton domain alternatives are the strongest propositions in the alternative value of CP.[16] It thus also follows immediately that the alternatives are ordered by disjunction. The disjunctive statement 'More than two students introduced a to c or more than two students introduced a to d' is equivalent to the proposition $\lambda w.\exists x \in \{a\}.\exists y[\geq 2\ \mathit{student}_w(y) \wedge \exists z \in \{c, d\}[\mathit{introduce}_w(y, x, z)]]$, (85). In other words, disjoining two alternatives returns another one in the set of alternatives. Adding the remaining singleton domain alternatives to the disjunction on the left side in (85) results in a statement equivalent to the ordinary value of CP.

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[15] For expository reasons, I indicate the witness set by having the numeral in the restrictor of the existential quantifier.

[16] The complete entailment relationships are given in (i).

(i)
$$\begin{array}{l} \exists x \in D_{\{a\}}. \geq 2y.\exists z \in D'_{\{c\}}.\phi \\ \exists x \in D_{\{a\}}. \geq 2y.\exists z \in D'_{\{d\}}.\phi \end{array} \subset \exists x \in D_{\{a\}}. \geq 2y.\exists z \in D'_{\{c,d\}}.\phi$$

$$\begin{array}{l} \exists x \in D_{\{b\}}. \geq 2y.\exists z \in D'_{\{c\}}.\phi \\ \exists x \in D_{\{b\}}. \geq 2y.\exists z \in D'_{\{d\}}.\phi \end{array} \subset \exists x \in D_{\{b\}}. \geq 2y.\exists z \in D'_{\{c,d\}}.\phi$$

$$\begin{array}{l} \exists x \in D_{\{a\}}. \geq 2y.\exists z \in D'_{\{c\}}.\phi \\ \exists x \in D_{\{b\}}. \geq 2y.\exists z \in D'_{\{c\}}.\phi \end{array} \subset \exists x \in D_{\{a,b\}}. \geq 2y.\exists z \in D'_{\{c\}}.\phi$$

$$\begin{array}{l} \exists x \in D_{\{a\}}. \geq 2y.\exists z \in D'_{\{d\}}.\phi \\ \exists x \in D_{\{b\}}. \geq 2y.\exists z \in D'_{\{d\}}.\phi \end{array} \subset \exists x \in D_{\{a,b\}}. \geq 2y.\exists z \in D'_{\{d\}}.\phi$$

$$\subset \exists x \in D_{\{a,b\}}. \geq 2y.\exists z \in D'_{\{c,d\}}.\phi$$

(85) $\exists x \in D_{\{a\}}. \geq 2y.\exists z \in D'_{\{c\}}.\phi \vee \exists x \in D_{\{a\}}. \geq 2y.\exists z \in D'_{\{d\}}.\phi = \exists x \in D_{\{a\}}. \geq 2y.\exists z \in D'_{\{c,d\}}.\phi$

The question denotation is therefore as in (86), which is the desired Hamblin/Karttunen dentotation:

(86) $[\![(83a)]\!]^g = \{p : \exists x.\exists z[p = \lambda w.existsy[\geq 2\ student_w(y) \wedge introduce_w(y, x, z)]]\}$

For the example with the DE-indefinite, (83b), the following values for CP obtain:

(87) a. $[\![\text{CP}]\!]^g = \lambda w.\exists x \in \{a, b\}.\exists y[\leq 2\ student_w(y) \wedge \exists z \in \{c, d\}[introduce_w(y, x, z)]]$

b. $[\![\text{CP}]\!]^{Alt} = \{\lambda w.\exists x \in D.\exists y[\leq 2\ student_w(y) \wedge \exists z \in D'[invite_w(y, x, z)]] \mid \emptyset \neq D \subseteq \{a, b\}, \emptyset \neq D' \subseteq \{c, d\}\}$

This time the wh-in-situ expression is in a DE-environment, whereas the moved wh-element is not. This means that the entailments between the propositions in the alternative value of CP are the same as for example (64a) above, where a negative quantifier caused intervention. That is, the propositions where the higher existential quantifier ranges over a singleton domain and the lower one over a two-membered domain are the strongest.[17] From the discussion of example (64a) we already know that the alternatives are not ordered under disjunction. The disjunction 'At most two students introduced a to c or at most two students introduced a to d' is not equivalent to the proposition $\lambda w.\exists x \in \{a\}.\exists y[\leq 2\ student_w(y) \wedge \exists z \in \{c, d\}[introduce_w(y, x, z)]]$, (88). The latter proposition can be paraphrased as 'At most two students introduced a to c or d'.

[17] In other words, the entailments are as follows:

(i) $\exists x \in D_{\{a\}}. \leq 2y.\exists z \in D'_{\{c,d\}}.\phi \subset \begin{matrix}\exists x \in D_{\{a\}}. \leq 2y.\exists z \in D'_{\{c\}}.\phi \\ \exists x \in D_{\{a,b\}}. \leq 2y.\exists z \in D'_{\{c,d\}}.\phi\end{matrix}$

$\exists x \in D_{\{b\}}. \leq 2y.\exists z \in D'_{\{c,d\}}.\phi \subset \begin{matrix}\exists x \in D_{\{b\}}. \leq 2y.\exists z \in D'_{\{c\}}.\phi \\ \exists x \in D_{\{a,b\}}. \leq 2y.\exists z \in D'_{\{c,d\}}.\phi\end{matrix}$

$\subset \quad \exists x \in D_{\{a,b\}}. \leq 2y.\exists z \in D'_{\{c\}}.\phi$

(ii) $\exists x \in D_{\{a\}}. \leq 2y.\exists z \in D'_{\{c,d\}}.\phi \subset \begin{matrix}\exists x \in D_{\{a\}}. \leq 2y.\exists z \in D'_{\{d\}}.\phi \\ \exists x \in D_{\{a,b\}}. \leq 2y.\exists z \in D'_{\{c,d\}}.\phi\end{matrix}$

$\exists x \in D_{\{b\}}. \leq 2y.\exists z \in D'_{\{c,d\}}.\phi \subset \begin{matrix}\exists x \in D_{\{b\}}. \leq 2y.\exists z \in D'_{\{d\}}.\phi \\ \exists x \in D_{\{a,b\}}. \leq 2y.\exists z \in D'_{\{c,d\}}.\phi\end{matrix}$

$\subset \quad \exists x \in D_{\{a,b\}}. \leq 2y.\exists z \in D'_{\{d\}}.\phi$

Therefore one does not arrive at the ordinary value of CP by disjoining all the singleton domain alternatives. The denotation of the question is correctly predicted to be the empty set.

(88) $\exists x \in D_{\{a\}}. \leq 2y.\exists z \in D'_{\{c,d\}}.\phi \vee \exists x \in D_{\{a\}}. \leq 2y.\exists z \in D'_{\{c\}}.\phi \neq \exists x \in D_{\{a,b\}}. \leq 2y.\exists z \in D'_{\{c,d\}}.\phi$

It is clear that this result generalizes to all the other examples involving DE-indefinites as interveners. The reason is that the specific example discussed in the present subsection is already covered by the analysis of intervening negation in the preceding section. This result is significant, as it distinguishes between the present approach and other semantic as well as syntactic analyses of intervention effects. Regarding the difference between UE- and DE-interveners the present approach is clearly preferable.

4.6.2 Intervening focus

Remember that focused constituents also cause intervention effects. In particular recall the data in (89) and (90) repeated from subsection 4.2.2.

(89) a. *Wen hat nur der HANS wann angerufen?
who has only the Hans when called

b. Wen hat wann nur der HANS angerufen?
who has when only the Hans called
'Who did only Hans call when?'

(90) a. *Wen hat sogar der HANS wann angerufen?
who has even the Hans when called

b. Wen hat wann sogar der HANS angerufen?
who has when even the Hans called
'Who did even Hans call when?'

The present account also predicts that intervention effects should arise in (89a) and (90a). It does so because the focus operators *nur* and *sogar* cause intervention like other quantifiers. This distinguishes our analysis from Beck's 2006 where it is the focus itself that is responsible

for intervention.[18] I will return to this approach in subsection 4.7.1.1 below.

Let us first consider the examples in (89).[19] The lexical entry for *nur* 'only' assumed below is Horn's 1969 meaning. According to this meaning, *only* presupposes that ϕ – the prejacent or the sentence without *only* – is true. *Only* takes two arguments: a set of contextually relevant alternatives to a proposition p, $g(C)$, and p itself. Assume p is the denotation of ϕ. *Only* then asserts that all contextually relevant alternatives to p not entailed by p are false. With regard to the notion of alternatives relevant here, we follow Rooth (1985). That is, the contextually relevant alternatives form a subset of the focus value of p. The focus value for a given constituent A in the present analysis is just the alternative value of A with the focused part being replaced by its alternatives of the same type.[20]

(91) $[\![\text{only}]\!](g(C))(p)(w) = 1$ iff $\forall q \in g(C)[q(w) = 1 \rightarrow p \subseteq q]$
if $p(w) = 1$, and
$g(C) \subseteq [\![\phi]\!]^f$, otherwise undefined

This means that the propositions in the alternative value of CP will necessarily become more complicate, since both the assertive and the presuppositional component must be considered. I will therefore simplify the example from above by only including one wh-expression, namely the in-situ one. We have already seen above that the account given for such abstract representations is completely generalizable to actual multiple wh-questions with intervention effects. Let us therefore consider the LF in (92).

(92) Q [$_{\text{CP}}$ has only C [who 1[the Hans$_F$ t$_1$ invited]]]

[18] This is strictly speaking not correct. It is not the focus, but rather the obligatory ∼-operator interpreting focus (Rooth 1992b) that causes intervention.

[19] Also cf. the discussion in chapter 2 subsection 2.2.1.

[20] In the discussion below I will disregard Rooth's 1992b ∼-operator. Rather I will assume that *only* directly associates with focus. This assumption is only made for expository reasons.

According to the meaning of *only* in (91) and our assumptions about the interpretation of wh-questions, the alternative value for the CP-constituent is as in (93). Here we assume that in the ordinary value the domain for the existential quantifier introduced by the wh-expression consists just of the individuals a and b.[21]

(93)
$$\left\{ \begin{array}{l} \lambda w : \exists x \in D_{\{a,b\}}[invite_w(h,x)].\forall p \in C[p(w) \rightarrow \lambda w'.\exists x \in D_{\{a,b\}}[invite_{w'}(h,x)] \subseteq p] \\ \lambda w : \exists x \in D_{\{a\}}[invite_w(h,x)].\forall p \in C[p(w) \rightarrow \lambda w'.\exists x \in D_{\{a\}}[invite_{w'}(h,x)] \subseteq p] \\ \lambda w : \exists x \in D_{\{b\}}[invite_w(h,x)].\forall p \in C[p(w) \rightarrow \lambda w'.\exists x \in D_{\{b\}}[invite_{w'}(h,x)] \subseteq p] \end{array} \right\}$$

None of the propositions in the alternative value entails another one in it. The presupposed content is an UE-environment. Therefore, just looking at the presuppositions, the propositions with the singleton domain alternatives asymmetrically entail the alternative with the largest domain. When we now consider the assertive components, we notice that the entailment goes the other way. To see this assume that *Maria* is the only contextual salient alternative to *Hans*. What the assertive component of the proposition with the largest domain says is that the proposition 'Maria invited a or Maria invited b' is false. But this entails that both disjuncts of this proposition are false, as well. The disjuncts are just the propositions which the singleton domain alternatives require to be false. In other words, the assertion of the alternative with the $\{a, b\}$-domain entails the singleton domain alternatives. This moreover means that the alternatives in (93) as a whole are non-monotone, i.e., they do not entail each other. It seems that the alternatives in (93) can only really be alternatives to each other if the given context satisfies the presupposition of all of them. Since the presuppositions of the singleton domain alternatives are the strongest and they are non-equivalent, the context must be the union of those worlds making the propositions 'Hans invited a' and 'Hans invited b' true. In this situation all that we have to care about when computing the value of the question in (92) are the assertive components. But nevertheless, we run into the problem that the assertions in (93) are not ordered under disjunction. This can be easily seen by considering the paraphrases of the assertions in

[21] In the following, I use Heim and Kratzer's 1998 convention to indicate presuppositions. $\lambda\xi : \phi(\xi).\psi(\xi)$ denotes a partial function, in particular a function that is only defined for objects of which ϕ is true.

(93). The assertions of the singleton domain alternatives are just 'Maria invited *a* is false' and 'Maria invited *b* is false'. The assertion of the first alternative in (93) is, as already said above, the proposition that 'Maria invited *a* or Maria invited *b* is false'. The disjunction of the former two alternatives is not equivalent to the latter (94).

(94) 'Maria invited *a* is false' $\vee$ 'Maria invited *b* is false' $\neq$ 'Maria invited *a* or Maria invited *b* is false'

Therefore the alternative value of CP is not ordered by disjunction and the question value of (92) is the empty set.

What if the wh-expression takes scope above the focus operator as in (95)?

(95) Q [$_{\text{CP}}$ who 1[has only C the Hans$_F$ t$_1$ invited]]

In this case the alternatives in the alternative value of CP change accordingly. The existential quantifier now binds a variable in the presupposition and the assertion:

(96)
$$\left\{ \begin{array}{l} \lambda w.\exists x \in D_{\{a,b\}} : \mathit{invite}_w(h,x).\forall p \in C[p(w) \rightarrow \lambda w'.\mathit{invite}_{w'}(h,x) \subseteq p] \\ \lambda w.\exists x \in D_{\{a\}} : \mathit{invite}_w(h,x).\forall p \in C[p(w) \rightarrow \lambda w'.\mathit{invite}_{w'}(h,x) \subseteq p] \\ \lambda w.\exists x \in D_{\{b\}} : \mathit{invite}_w(h,x).\forall p \in C[p(w) \rightarrow \lambda w'.\mathit{invite}_{w'}(h,x) \subseteq p] \end{array} \right\}$$

Since the existential quantifier is now in an UE-environment the singleton domain alternatives are the strongest ones. Moreover, the disjunction of the singleton domain alternatives is now equivalent to the alternative with $\{a, b\}$ as domain. The disjunction of the former two has the same meaning as in the preceding example. But the alternative with the larger domain can now be paraphrased as 'Maria invited *a* is false or Maria invited *b* is false'. As we have seen in (94), this is just the meaning of the disjoined singleton domain alternatives. As a consequence, the denotation of (95) is not empty: The singleton domain alternatives make up the question denotation. The resulting set is equivalent to the Hamblin/Karttunen denotation in (97).

(97) $[\![(95)]\!]^g = \{p : \exists x[p = \lambda w.\forall q \in C[p(w) \rightarrow \lambda w'.\mathit{invite}_{w'}(h,x) \subseteq q]]\}$

This means that the present approach predicts a difference in acceptability between (92) and (95). This effect immediately generalizes to the actual multiple-wh examples in (89) above. As has been shown in the previous section, the present account simply relies on mutual scope between an intervener and the wh-in-situ expression. It does not matter how many overtly moved wh-elements there are.

Let us now turn to the examples involving *even*. Assume for this the semantics in (98) following the arguments given in Rooth (1985) and Guerzoni (2004). This entry asserts that the prejacent is true. Moreover, it presupposes following Horn (1969) that all focus alternatives to the prejacent are more likely than it ($p > q$ denotes that p is more likely than q in the following).

(98) $[\![\text{even}]\!](g(C))(p)(w) = 1$ iff $p(w)$
if $\forall q \in g(C)[q \neq p \rightarrow q > p]$, and
$g(C) \subseteq [\![\phi]\!]^f$, otherwise undefined

Parallel to our discussion of *only*, assume the LF in (99) as an example for *even* causing an intervention effect.

(99) Q [$_{\text{CP}}$ has even C [who 1[the Hans$_F$ t$_1$ invited]]]

The alternative value for the CP-constituent is then as in (100), assuming that a and b are the relevant individuals. Considering the assertive component, we note that the singleton domain alternatives asymmetrically entail the alternative with the domain $\{a, b\}$. The same is true in the presuppositional component. To see this assume that Maria and Susi are the relevant alternatives for *Hans*. Then, if it is both more likely that Maria invited a and that Susi invited a than that Hans invited a, then it must also be true that Maria inviting a or b is more likely than Hans inviting a or b, and similarly for the proposition with Susi.

(100)
$$\left\{\begin{array}{c}
\lambda w : \forall p \in C[p \neq \lambda w'.\exists x \in D_{\{a,b\}}[invite_{w'}(h,x)] \rightarrow q > \lambda w'.\exists x \in D_{\{a,b\}}[invite_{w'}(h,x)].\\
\exists x \in D_{\{a,b\}}[invite_{w}(h,x)]\\
\lambda w : \forall p \in C[p \neq \lambda w'.\exists x \in D_{\{a\}}[invite_{w'}(h,x)] \rightarrow q > \lambda w'.\exists x \in D_{\{a\}}[invite_{w'}(h,x)].\\
\exists x \in D_{\{a\}}[invite_{w}(h,x)]\\
\lambda w : \forall p \in C[p \neq \lambda w'.\exists x \in D_{\{b\}}[invite_{w'}(h,x)] \rightarrow q > \lambda w'.\exists x \in D_{\{b\}}[invite_{w'}(h,x)].\\
\exists x \in D_{\{b\}}[invite_{w}(h,x)]
\end{array}\right\}$$

Notice now that the propositions in (100) are not ordered by disjunction. Since the entailments go from singleton domain alternatives to alternatives with larger domains in general, let us restrict our attention to the presuppositions of the propositions in (100). The disjunction of the singleton domain alternatives is not equal to the alternative with the domain $\{a, b\}$. Assume again that Maria and Susi are the alternatives for Hans. Then if the right side of the non-equivalence statement in (101) is true, it need not be the case that the left side is true, as well. Assume that Maria inviting *a* is more likely than Hans doing so. Moreover, it is more likely that Susi invites *b* than Hans doing so. In this case the right side is true, but the left side is not. The left side would require that either both Maria and Susi inviting *a* is more likely than Hans doing so, or both Maria and Susi inviting *b* is more likely.

(101) '$\forall x \in Alt(Hans)$[*x* inviting *a* is more likely than Hans inviting *a*]' $\vee$ '$\forall x \in Alt(Hans)$[*x* inviting *b* is more likely than Hans inviting *b*]' $\neq$ '$\forall x \in Alt(Hans)$[*x* inviting *a* or *b* is more likely than Hans inviting *a* or *b*]'

Thus, the alternatives in (100) are not ordered by disjunction. Because of this the question denotes the empty set.

If the wh-expression has scope over *even* as in (102), the alternative value in (103) obtains.

(102) Q [$_{CP}$ who 1[has even C the Hans$_F$ t$_1$ invited]]

(103)
$$\left\{\begin{array}{c} \lambda w.\exists x \in D_{\{a,b\}} : \forall p \in C[p \neq \lambda w'.invite_{w'}(h,x) \rightarrow q > \lambda w'.invite_{w'}(h,x)]. \\ invite_w(h,x) \\ \lambda w.\exists x \in D_{\{a\}} : \forall p \in C[p \neq \lambda w'.invite_{w'}(h,x) \rightarrow q > \lambda w'.invite_{w'}(h,x)]. \\ invite_w(h,x) \\ \lambda w.\exists x \in D_{\{b\}} : \forall p \in C[p \neq \lambda w'.invite_{w'}(h,x) \rightarrow q > \lambda w'.invite_{w'}(h,x)]. \\ invite_w(h,x) \end{array}\right\}$$

The singleton domain alternatives have interpretations more or less as in the preceding example. The proposition with the domain $\{a, b\}$ now can be paraphrased as 'Every alternative to Hans inviting a is more likely than Hans doing so or Every alternative to Hans inviting b is more likely than Hans doing so'. This, however, is equivalent to the disjunction of the singleton domain alternatives, which we have already discussed above. In other words, the question denotation is non-empty. It contains the singleton domain alternatives as members. This is equivalent to the Hamblin/Karttunen denotation in (104).

(104) $[\![(102)]\!]^g = \{p : \exists x[p = \lambda w.\forall q \in g(C)[q \neq \lambda w'.invite_{w'}(Hans, x) \rightarrow q > \lambda w'.invite_{w'}(Hans, x)].invite_w(Hans, x)]\}$

In summary, the present approach correctly predicts intervention effects for both intervening *only* and *even* if there is a wh-expression in the scope of the focus operator.[22]

[22] What about questions where there is a focused intervening constituent but there is no overt focus operator? Beck (2006) cites (i) as a case in point. Her analysis can straightforwardly deal with such examples because in her theory it is the ∼-operator evaluating the focus that causes intervention. In the present approach I would have to claim that the intervention effect is caused by an exhaustive interpretation of the focused constituent. That is, I would assume a covert exhaustive operator with a meaning similar to *only* (cf. Fox (2007), (Groenendijk and Stokhof 1984), Krifka (1995), Schulz and Van Rooij (2006) a.o.). This way the analysis for *only* offered in the text would carry over to examples like (i). It should also be noted that intervention effects in cases like (i) are somewhat weaker than the ones discussed in the text. This follows naturally if both an interpretation with an exhaustive operator and one without is available.

(i) ??Wen hat LUISE wo gesehen?
who has Luise where seen
'Where did LUISE see who?'
(Beck 2006:32)

4.6.3 Cross-linguistic considerations

The present approach traces intervention effects to the semantic contribution of certain operators. In particular, it is argued that if a wh-expression is in the scope of such an operator at LF, the denotation of the question will be the empty set. This denotation, it is argued, is the cause of the perceived degradedness of the questions under discussion. As discussed above, this approach predicts that uninterpretability of wh-questions should arise in languages where scrambling is an option if the one of the interveners introduced so far intervenes between the Q-operator and a wh-expression. Kim (2002) (also cf. Beck (2006)) notes that intervention effects with quantifiers, however, are not as stable as intervention effects caused by focus operators. Korean, in particular, is a language that exhibits intervention effects, has scrambling, and yet not all quantifiers lead to intervention. Kim shows that negation, universal quantifiers, and focus operators cause intervention effects. Quantifiers like *taepupun* 'most', however, do not lead to degradedness.

(105) **taepupun-ûi hansaeng-tûl-i** nuku-lûl hoichang-ûlo ch'uch'ônha-ôss-ni?
most-Gen student-PL-Nom who-Acc president-as recommend-Past-Q
'Who did most students recommend as president?'

(Kim 2002:(14))

(105), from the present perspective, is not too surprising. It can be argued that *most* is an UE-indefinite. Therefore we do not expect it to cause intervention. (106), Kim argues, also does not show intervention effects. This is expected for the quantifier *chachu* 'often', which is again arguably UE.[23] One could therefore take the data in (104) and (106) to be additional motivation

[23]Beck (2006) argues that this state of affairs differs from the one found in German, where the equivalent of *often* does cause intervention (i). Recall, however, that UE-indefinites trigger a negative scalar implicature that I assumed to be the cause of intervention in such cases. Indeed, it seems that the effect is not as strong as indicated in (i) (the judgements are Beck's).

(i) a. *Luise zählt auf, welche Uni oft welche Linguisten eingeladen hat
Luise enumerates which university often which linguists invited has
b. Luise zählt auf, welche Uni welche Linguisten oft eingeladen hat.
Luise enumerates which university which linguists often invited has
'Luise enumerates which university often invited which linguists.'
(Beck 2006:9)

for the analysis argued for in the present chapter.

The universal quantifier *hangsang* 'always' in Korean, on the other hand, is problematic. Our approach would expect an intervention effect. But as (106) also shows, this is not the case.

(106) Minsu-nûn **hangsang/chachu** nuku-lûl p'at'i-e teliko ka-ss-ni?
Minsu-Top always/often who-Acc party-to take-Past-Q
'Who did Minsu always/often take to the party?'

(Kim 2002:(14))

Furthermore Beck (2006) cites a paper presented by Ruangjaroon in 2002 where it is argued that the equivalent of the negative quantifier *nobody* in Thai (107) does cause intervention, whereas the negation *not* does not (108) (cited after Beck (2006)) This situation is puzzling not only under the present approach.

(107) *mâymiikhray chôop ?àan nangsii lêmnay
nobody like read book which
'Which books does nobody like to read?'

(Beck 2006:8)

(108) Nít mây síi ?aray
nit not buy what
'What didnt Nit buy?'

(Beck 2006:10)

Given the fact that focus always causes intervention in Korean, as argued by Kim (2002), Beck (2006) draws the conclusion that the typologically stable interveners are the ones that are focus related. Intervention by quantifiers, on the other hand, is subject to variation, as evidenced by the data in (104)-(105) and (107)-(108). As we will see in subsection 4.7.1.1, Beck's explanation of intervention effects is modeled on this intuition – that is, focus causes intervention in all cases, even in the cases where it seems that a quantifier is the culprit. The UE-interveners in (104) and (105) do not warrant this conclusion, as they do not represent a problem for the current proposal. They are only problematic for approaches to intervention that treat all quantifiers alike. The fact

that the universal quantifier in the Korean example in (106) does not cause intervention, on the other hand, is problematic. However, as already noted and as shown by (109), other universal quantifiers do cause intervention in Korean.

(109) a. ??**nukuna-ka** ônû kyosu-lûl chonkyôngha-ni?
everyone-Nom which professor-Acc respect-Q

b. ônû kyosu-lûl$_i$ **nukuna-ka** t$_i$ chonkyôngha-ni?
which professor-Acc everyone-Nom respect-Q
'Which professor does everyone respect?'

(Kim 2002:(13))

Given the fact that in both Korean and in Thai – the two main languages drawn on by Beck (2006) to argue that intervention effects caused by quantificational interveners are typologically unstable – there are universal and negative interveners, respectively, it does not seem likely to me that a theory relegating intervention effects to intervention by focus is better off than the present theory. In fact what such a theory has to do, as we will see in the following section, is to stipulate that the universal quantifier in (109) associates with focus and thereby causes intervention, whereas the one in (106) does not do so, and respectively for the negative elements in Thai. I.e., the line between interveners and non-interveners is drawn at a completely arbitrary point even in a focus-based theory of intervention effects. It must also be noted that a syntactic approach to intervention effects will have to make similar stipulations. It is unclear to me why (106) and (108) do not behave as predicted. But at least there is a straightforward story for why the well-behaved universal quantifiers and negations reviewed in this subsection are actually well-behaved. We already know that this is not the case for a syntactic approach. And as we will see, this is not the case in a focus-based theory either. Regarding the problematic data, it must be said that we could make stipulations to exclude them as easily as in any other approach. But since I would be relying only on the two problematic sentences discussed above when doing so, I will leave this for further research.

Summarizing, there is still much cross-linguistic research to be done. But I must conclude that the present approach is not in a worse position with respect to certain challenges posed by

some languages than other analyses.

4.7 Comparison with other semantic approaches

4.7.1 Semantic approaches to intervention effects in wh-questions

In addition to syntactic analyses there have been, to my knowledge, two types of semantic analyses of intervention effects: The first type of approach is exemplified by Haida (2007) and Honcoop (1998), whereas the second one is advocated by Beck (2006), Cable (2007), Kratzer and Shimoyama (2002), and Shimoyama (2006). The common feature of the former two analyses is that the intervener is claimed to block binding of variables in a particular way.[24] The second approach, on the other hand, makes intervention effects follow from the behavior of semantic operators in an alternative-based semantics. I will discuss Beck's 2006 approach (Cable's 2007 analysis shares essential properties with Beck's), and then Kratzer and Shimoyama's 2002 analysis, which differs from the former in some details but is similar in intuition to it – albeit it is actually not meant to cover intervention effects with wh-in-situ questions, as we will see.

4.7.1.1 Focus semantics and intervention effects

Beck (2006) following in particular Kim (2002) identifies the compositional semantics of focus as the reason behind intervention effects. The reason for making focus essential is that it seems to be the most reliable intervener cross-linguistically (cf. the discussion in subsection 4.6.3 and the worries raised there). Beck's intuition is the following: Assuming a bi-dimensional semantics for focus (Rooth 1985, 1992b), the role of focus on a constituent is to contribute alternatives to the meaning of that constituent. She argues that wh-expressions do not make an

[24] I will not discuss Honcoop (1998) approach here in any detail. Honcoop argues that intervention effects with wh-in-situ expressions show a general property of variable binding: Binding is blocked by certain operators, for instance negation. Because of this he assumes that such intervention effects should not be distinguished from, for instance, negative islands. As discussed by Beck (2006), this is a questionable assumption. Negative islands block all movement, whereas we have seen that the intervention effects discussed in the text only arise with wh-in-situ expressions. It is therefore unlikely that the two phenomena should be treated on a par. Haida's 2007 approach attempts a unification of Honcoop's analysis with intervention effects in wh-in-situ questions.

ordinary semantic contribution but only a contribution to the focus-dimension. In other words, the role of wh-words is to contribute alternatives, but their ordinary value is undefined. The Q-operator uses the resulting propositional alternatives for the resulting question denotation. A focus operator that intervenes between the wh-word and the Q-operator uses up the alternatives contributed by the wh-expression. Therefore they are not accessible anymore by the Q-operator which leads to ungrammaticality.

Beck departs from Rooth's original framework by following the implementation given by Kratzer (1991). Each constituent A has an ordinary semantic value $[\![A]\!]^g$ and a focus value $[\![A]\!]^{g,h}$. In addition to the assignment function g there is a second assignment function h which is responsible for the focus value. In particular, foci are indices and serve as distinguished variables of the same type as constituent A to which they are attached. The variables are interpreted by h. That is, the focus value of constituent A is the value assigned by h to the focus index. If there is no index present, the focus value is identical to the ordinary value, where the ordinary value is just the interpretation of A relative to g. g never takes focus indices into account. The interpretation rules are given in (110). Functional application proceeds as usual, (111).

(110) *Denotations of simple elements of type τ*

a. $[\![A_{F_i}]\!]^g = g(A)$

b. $[\![A_{F_i}]\!]^{g,h} = h(i)$

(111) *Functional application*

If A is a branching node with daughters B_σ and $C_{\langle\sigma\tau\rangle}$, then

a. $[\![A]\!]^g = [\![C]\!]^g([\![B]\!]^g)$, and

b. $[\![A]\!]^{g,h} = [\![C]\!]^{g,h}([\![B]\!]^{g,h})$

As in Rooth's original proposal, focus is always interpreted by a $\sim$-operator. The $\sim$-operator is defined as in (112) which is a reformulation of Rooth's entry. It does the following: It adds the presupposition that the contextually determined set of alternatives is a subset of the set of focus assignments to the sister constituent of the $\sim$-operator. In other words, the contextual

alternatives must be a subset of the focus alternatives, computed by quantifying over the possible assignments h to the sister constituent. Moreover, the ∼-operator resets the focus value of the constituent dominating the ∼-operator to the ordinary value of its sister. As a consequence the semantic contribution of the focus in the scope of the ∼-operator – that is, the introduction of alternative meanings – is irretrievable at further stages in the computation.

(112) If X=[∼ C Y] then

a. $[\![X]\!]^g = [\![Y]\!]^g$ if $g(C) \subseteq \{[\![Y]\!]^{g,h'} : h' \in H \& h'$ is total$\}$, undefined otherwise;

b. $[\![X]\!]^{g,h} = [\![X]\!]^g$

(Beck 2006:15)

Operators such as *only* do not directly associate with focus but rather via an intervening ∼-operator. This means that *only* takes two arguments, the set of contextual alternatives as provided by the ∼-operator and the ordinary value of its sister constituent. (113) conforms to (91) above with the only difference that in (113) the supply of alternatives is left to the ∼-operator.

(113) $[\![\text{only}]\!](g(C))(p)(w) = 1$ iff $\forall q \in g(C)[q(w) = 1 \rightarrow p \subseteq q]$
if $p(w) = 1$, otherwise undefined

Under this view, a sentence like (114a) has the LF in (114b)

(114) a. Only JOHN called Mary

b. only C [∼ C [$_{IP}$ John$_{F2}$ called Mary]]

The interpretation of (114b) is given in (115). (115) asserts that each true alternative in the set of contextual alternatives $g(C)$ must be entailed by the proposition that John called Mary. $g(C)$ is required to be a subset of the set of assignments h to IP in (114)– that is, it must be a subset of the alternatives to IP with *John* being replaced by its alternatives. Moreover, it is required that the proposition that John kissed Mary is true in the world of evaluation.

(115) $[\![(114)]\!]^g(w) = 1$ iff $\forall p \in g(C)[p(w) \rightarrow \lambda w'.call_{w'}(John, Mary) \subseteq p]$
if $g(C) \subseteq \{[\![[\text{John}_{F2} \text{ called Mary}]]\!]^{g,h'} : h' \in H\}$
$= g(C) \subseteq \{\lambda w'.call_{w'}(x, Mary) \mid x \in D\}$, and
$call_w(John, Mary) = 1$, otherwise undefined

As does the present chapter, Beck assumes a Hamblin/Karttunen semantics for the interpretation of questions – that is, a question denotes the set of its answers. The crucial point in her analysis is that wh-words only make a focus semantic contribution but are undefined in their ordinary semantic value. This means that wh-expressions have a focus index which is interpreted relative to the assignment function h, whereas the ordinary value is undefined:

(116) a. $[\![\text{who}_1]\!]^g$ = undefined
b. $[\![\text{who}_1]\!]^{g,h} = h(1)$

The Q-operator selectively binds the wh-variables it is coindexed with, as given in (117). In particular, it takes the focus value of its sister constituent, binds the coindexed wh-variables and forms a set of propositions from it.

(117) If X = [Q_i Y] then $[\![X]\!]^g = \lambda p.\exists x[p = [\![Y]\!]^{g,h[x/i]}]$
and $[\![X]\!]^{g,h} = \lambda p.\exists x[p = [\![Y]\!]^{g,h[x/i]}]$
(Beck 2006:16)

The LF for the question in (118a) is given in (118b). The interpretation corresponding to the exposition just given is as in (119). Note again that the Q-operator takes the focus value of its sister IP in order to form the question denotation. In other words, the ordinary value of IP is irrelevant for the meaning of the question. In fact, the ordinary value of IP is undefined, because the ordinary value of the wh-word is undefined and the undefinedness, of course, projects. Since the ordinary value of the IP does not play a role when computing the question denotation – that is, the ordinary value of the question –, this does not lead to undefinedness of the whole

sentence, though.

(118) a. Who called Mary?

b. [Q_2 [$_{IP}$ who$_2$ called Mary]]

(119) $[\![(118b)]\!]^g = \lambda p.\exists x[p = [\![[_{IP} \text{ who}_2 \text{ called Mary}]]\!]^{g,h[x/2]}]$

$= \lambda p.\exists x[p = \lambda w.called_w(x, Mary)]$

We are now in a position to discuss Beck's explanation of intervention effects. The infelicitous example in (120) with the LF in (121) is claimed to be ungrammatical because the sentence does not have a defined ordinary value, something that is required of each sentence according to Beck's theory. The reason for this undefinedness is as follows: The wh-in-situ expression *wo* has an undefined ordinary value. Because of this the ordinary value of constituent X is also undefined. Remember now the semantics of the ∼-operator. It resets the focus value of X' to the ordinary value of its sister X. Therefore both the ordinary and the focus value of X' are undefined. The same holds for Y. Q now takes the focus value of Y, binds the wh-variables in Y and forms the question denotation. But since the focus value of Y is undefined, so is the question denotation, i.e., the ordinary value of Z. This means that the undefinedness of the wh-in-situ expression leads to undefinedness of the whole question in case a focused constituent intervenes between Q and the wh-in-situ word. But this violates the principle that each sentence must have a defined truth value.

(120) *Wen hat nur der HANS wo gesehen?
whom has only the Hans where seen

(121) [$_Z$ $Q_{3,4}$ [$_Y$ wen$_3$ 1[nur C [$_{X'}$ ∼ C [$_X$ der Hans$_{F2}$ wo$_4$ t_1 gesehen]]]]]

For this account it is crucial that the ∼-operator evaluates all foci in its c-command domain. Notice that in contrast to Q, ∼ does not selectively bind focus indices. It unselectively evaluates them. Moreover, it resets the focus value to the ordinary value of its sister constituent. But if this value is undefined, so will be the focus value of every dominating node. As Q needs the

focus value of its sister to compute the ordinary value of the sentence, the sentence is undefined. In other words, the first operator making use of focus values dominating a wh-expression must be the Q-operator. This predicts that in case the wh-in-situ expression is scrambled over the focused constituent, grammaticality should result. The LF for the good (122) is as in (123). The focus value of X' is identical to the ordinary value of X. The ordinary values of the wh-expressions are again undefined, but the focus values are defined. Thus, the focus value of Y' is also defined, which is what is needed in order to guarantee that when Q applies to it, a defined ordinary value for Z is returned.

(122) Wen hat wo nur der HANS gesehen?
who has where only the Hans seen
'Who did only Hans see where?'

(123) $[_Z\ Q_{3,4}\ [_{Y'}\ wo_4\ 5\ [_Y\ wen_3\ 1[\text{nur C}\ [_{X'}\ \sim \text{C}\ [_X\ \text{der Hans}_{F2}\ t_5\ t_1\ \text{gesehen}]]]]]]$

In order to account for intervention caused by quantifiers, Beck assumes that quantifiers have a $\sim$-operator associated with them that evaluates the scope of the quantifier for focus. Since stress in the scope of quantifiers is not obligatory, however, the quantifier is not necessarily using the alternatives provided by the $\sim$-operator. It should also be noted that the proposal requires that wh-words are interpreted in place, i.e., they do not undergo movement to Q in order for semantic interpretation to be possible. Thus Beck's theory reduces intervention effects to the way compositional interpretation proceeds. As argued above, this is a desirable result. A number of questions with respect to the particular implementation arise, though. First, intervention effects disappear if the wh-in-situ expression is stressed:

(124) Wen hat niemand WO gesehen?
whom has nobody where seen
'Where did nobody see whom?'

The $\sim$-operator on the negative quantifier[25] resets the focus value to the ordinary value of its

[25]We will return to the issue of quantifiers having a $\sim$-operator immediately below.

sister constituent. But this value is undefined under Beck's analysis. Thus (124) should be ungrammatical. In fact, it is unclear how Beck's proposal would deal with focus on wh-expressions in general. First, since wh-words only have a defined focus value and make no ordinary semantic contribution, it is unclear what the difference between a focused and an unfocused wh-word would be. Consider the example in (125). Crucially, the operator *only* makes use of both the focus value of its sister and of the ordinary value, as seen above. It asserts that of all alternatives to the ordinary meaning of the sister of *only*, only those entailed by the ordinary meaning are true. But if the ordinary meaning is not defined, *only* has nothing to operate on. Slade (2010) makes a similar point.[26]

(125) Wen hat der Hans nur WO gesehen?
who has the Hans only where seen
'Where did Hans see only who?'

Even if a way is found to address this first problem, there is a further potential worry associated with (125). Beck's theory predicts an intervention effect for (125), even though there is neither an intervening focused constituent nor an intervening quantifier present. The reason for this is that what is actually causing intervention effects is the ∼-operator. But since *only* needs a ∼-operator in its scope in order to interpret focus, it will reset the focus value to an undefined ordinary value in (125), too. Consider the LF in (126) where it is assumed for simplicity that *nur* is adjoined to the propositional level. X has an undefined ordinary value. Because of the semantics of ∼, X' has an undefined focus value, and by extension Y does, too. Thus, Z will

[26]The proposal argued for in the present chapter does not run into similar problems. First, the ordinary value of wh-words is not undefined. Therefore it is in principle possible to give a focus semantic content to them that differs from the ordinary value. Moreover, since it is not the ∼-operator that causes intervention in our theory, it is possible to attribute an LF to (124) that does not lead to intervention. Assume that focused constituents can optionally undergo LF-movement (cf. the arguments in Krifka (2006), Wagner (2006a) and the references therein). Then (124) can have the LF in (i). Here the wh-in-situ is moved covertly – a movement that would be unavailable for a non-focused wh-in-situ expression – thereby escaping the intervention effect induced by the quantifier. The ∼-operator evaluating the focus contribution is attached even higher. This solution does not work in Beck's theory (cf. footnote 27 below).

(i) Q [$_{CP}$ wen 1[∼ C wo 2[niemand 3[t_3 t_1 gesehen t_2]]]

have an undefined ordinary value violating the constraint that each sentence must have a defined truth value.[27]

(126) [$_{Z}$ $Q_{3,5}$ [$_{Y}$ wen 2[nur C [$_{X'}$ ~ C [$_{X}$ der Hans wo_{F5} t_2 gesehen]]]]]

In sum, it thus seems that Beck's system predicts more intervention effects than are actually attested.

A further question arises with respect to the fact that in Beck's system wh-words introduce focus variables that get bound by the Q-operator. This is necessary for it to be possible that the ~-operator can ever cause intervention. But then it seems that Q should also be able to bind the focus variables on focused non-wh-expressions. But (127), of course, cannot have a question meaning. If the LF in (128) is assumed, however, it is predicted that (127) can have a question meaning. The interpretation for (128) is given in (129). Note that it is irrelevant that IP also has a defined ordinary value, which is not the case in actual wh-questions in Beck's theory. The reason is, again, that Q only makes use of the focus value of IP. And the focus value of IP is identical to the question where *John* is replaced by *who*.

(127) JOHN called Mary

#'Who called Mary?'

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[27] Sigrid Beck (p.c.) notes that one could argue that the wh-in-situ word is moved at LF resulting in the representation in (i). Here no wh-word is in the scope of the ~-operator. Thus X' and all dominating nodes would not end up with an undefined focus value.

(i) [Z $Q_{3,5}$ [Y' wo_{F5} 6[Y wen 2[nur C [X' ~ C [X der Hans t_6 t_2 gesehen]]]]]]

But two questions arise in this respect: If the focused *wo* is moved and the ~-operator is attached lower, how can the latter interpret the focus semantic contribution of the former, provided that we find a solution to the problem how focus on wh-words would be interpreted in Beck's theory to begin with. Under the LF in (126) the question would have a meaning similar to the same question without focus on *wo*. But this would, of course, be problematic, as *only* must necessarily associate with focus. This problem does not arise in the theory advocated in the present chapter. Moreover, as Beck herself notes (ii) is not grammatical under the reading where *nur* 'only' associates with *wen*. According to (i) it should be, though. This is so because in (i) we face the puzzling situation that *wo* is not in the scope of the ~-operator with respect to binding by Q, whereas it is somehow still in the scope of ~ with respect to focus interpretation.

(ii) *WEN hat Hans nur eingeladen?
who has Hans only invited

(128) $[_{\text{CP}}\ \text{Q}_3\ [_{\text{IP}}\ \text{JOHN}_{F3}\ \text{called Mary}]]$

(129) $[\![(128)]\!]^g = \lambda p.\exists x[p = [\![[_{IP}\ \text{JOHN}_{F3}\ \text{called Mary}]]\!]^{g,h[x/3]}]$

$= \lambda p.\exists x[p = \lambda w.call(x, Mary)(w)]$

Thus it seems that making wh-words identical in their focus value to focused constituents is not unproblematic. As was seen by the fact that wh-words can be stressed themselves, this assumption also leads to complications. It therefore appears that the very assumptions made about the interpretation of wh-questions in Beck's approach leads to unwelcome consequences. Unfortunately, it is not quite clear how the system could be moderately modified in order to avoid these problems. The reason for this is that the undefined ordinary value of wh-words together with the assumption that they only make a focus semantic contribution in the interpretation procedure is at the heart of the explanation of intervention effects. Abandoning any of these two assumptions would have the result that intervention effects cannot be accounted for anymore.

A further problematic aspect of Beck's theory is the fact that quantifiers are argued to always come with a ∼-operator so that they can cause intervention. At least this is the case in German. In languages where quantifiers do not or do only partially intervene, this ∼-operator is absent. This is a stipulation that one would like to eliminate given its ad-hoc flavor. But it is not easy to see how. Beck is, of course, aware of this. The more serious problem regarding the requirement that quantifiers have ∼-operators associated with them is that this approach completely misses the semantic generalization argued for in the present chapter. From Beck's point of view one has to ask oneself how come DE-indefinites must have a ∼-operator, whereas UE-indefinites must not. Again, this state of affairs can only be stipulated. But it cannot be derived in a systematic way.

4.7.1.2 Intervention effects in a Hamblin semantics

Kratzer and Shimoyama (2002) adopt a Hamblin semantics to account for certain scope effects found with Japanese indeterminate pronouns (also cf. Shimoyama (2006)). These indeterminate pronouns receive a wh- or quantificational interpretation via a suitable c-commanding operator.

Consider the representation in (130a). In case the lower operator is a wh-operator, the pronoun is interpreted like a wh-expression. In case the operator is quantificational, the pronoun functions as a quantifier. It is crucial that the first potential relevant operator must associate with the indeterminate pronoun. Thus (130b) is generally blocked. The situation shown in (130) is reminiscent of phenomena analyzed in the literature on syntactic minimality. Shimoyama (2006) gives arguments that minimality, however, is not the correct way to think about indeterminate pronouns and the operators involved.

(130) a. $[\ldots[\ldots \text{pro}_i \ldots \text{Op}_i]\ldots \text{Op}]$

b. $*[\ldots[\ldots \text{pro}_i \ldots \text{Op}]\ldots \text{Op}_i]$

Kratzer and Shimoyama assume that the semantic contribution of indeterminate pronouns is to introduce alternatives. The operators in (130) evaluate the alternatives introduced by the indeterminate pronouns. In other words, the alternatives expand via point-wise functional application until a relevant operator is found. In (130) the operator in the embedded position stops this expansion of alternatives so that the higher operator has no alternatives to operate on anymore. It can be seen that under this view syntactic minimality, at least for the phenomena discussed by Kratzer and Shimoyama, can and should be dispensed with. Minimality in this system is a reflex of the way semantic composition works: Alternatives expand until an operator is reached that consumes all the alternatives. Further relevant operators cannot use the alternatives anymore.

Although Kratzer and Shimoyama do not extend their analysis to intervention effects found with wh-in-situ expressions, one could try to carry over their approach to the data reviewed so far.[28] On the one hand, the proposal shares some insights with Beck's 2006 discussed in the preceding subsection. On the other hand, it is also stricter than Beck's. Beck notes that Kratzer and Shimoyama's theory makes all alternative-evaluating operators block the expansion

[28]In fact, they are careful not to assume the analysis sketched in the text for classical intervention effects. For these they assume Pesetsky's 2000 proposal according to which feature movement is subject to intervention, whereas covert phrasal movement is not (Pesetsky himself does not offer a reason as for why intervention arise in the first place, though). In other words, they must assume a version of the syntactic approach outlined in subsection 4.2.1 above. This means that the concerns raised about such theories carry over to their analysis of these effects, as well.

of alternatives. This is, however, problematic for data like (131). Here the ∼-operator belonging to *only* associates from a matrix position with a focus embedded inside a question. Kratzer and Shimoyama would predict that the Q-operator evaluates the alternatives in its scope. But then the ∼-operator should not have access to the alternatives introduced by the focus anymore. This is the very reason why Beck made the Q-operator a selective binder, whereas the ∼-operator is unselective. Only the latter evaluates all alternatives. The former lets through alternatives generated by expressions that are not coindexed with it.[29]

(131) Ich habe nur gefragt, wen MARIA gesehen hat
I have only asked who Maria seen has
'I only asked who Maria saw.'

One might be able to remedy this problem by postulating that the Q-operator applies in a point-wise manner to its argument. This has the consequence that the alternatives keep expanding. The result would however be that the alternatives introduced by the wh-expression are also still accessible at the level of the ∼-operator in (131). This would presumably cause further complications, as the set of alternatives relevant for the ∼-operator is now bigger than before. It could potentially contain unwelcome alternatives.[30]

4.7.1.3 Issues common to alternative-semantic theories of intervention effects

The possible route of reconciling Kratzer and Shimoyama's 2002 theory with the example in (131)– remember that they themselves do not extend their theory to intervention effects in wh-questions – highlights a general problem for the semantic approaches reviewed so far. What functions as an intervener in these proposals must be stipulated lexically. I.e., some operators must be such that they always stop alternatives from expanding, which means that they either do not combine point-wise with their argument, or alternatively that they reset the focus value.

[29] The present proposal does of course not run into any problem with (131).

[30] A further way to address this problem is to keep the alternatives contributed by wh-expressions and the ones resulting from focus separate. How this would interact with the account for intervention effects sketched in the text, is not a trivial question, however.

Other operators, such as the Q-operator, apparently must be allowed to let alternatives be passed up for further semantic computation. This is particularly troublesome for the data discussed in the preceding sections that were used to motivate the approach defended in the present chapter. Remember that UE-indefinites do not cause intervention effects, whereas DE-ones do. Kratzer and Shimoyama, and Beck can of course stipulate this behavior. In both cases it would have to be claimed that UE-indefinites let the alternatives of the wh-expression in their scope expand further, whereas DE-indefinites are not allowed to do so. But it seems that by allowing this type of lexical stipulation a linguistic generalization is missed. I therefore conclude that these semantic approaches to intervention effects are in need of modification in order to insightfully account for the data that the present account straightforwardly predicts.

Moreover, the following problem arises for theories where an operator is said to cause intervention due to its alternative-consuming behavior: The general setup of the two types of theories discussed in the present subsection is such that certain operators evaluate the unevaluated alternatives provided by all the elements contributing alternatives following them linearly. This way higher operators do not have any material to work on anymore. Therefore it is essential that focus operators like *only* are at least able to associate with all foci following them linearly and not yet evaluated by another operator. As is well-known, German *nur* does not seem to behave this way. Preverbal *nur*, in particular, cannot associate with a focus embedded in the verbal constituent. (132) cannot have the reading where all propositions with both *Hamburg* and *new* replaced by alternatives are false except for the denotation of the prejacent itself. Rather *new* must be contrastively focused. If *nur* is adjoined to the DP rather than to the clause – as would be predicted under a V2-analysis of German anyway – this state of affairs immediately follows. But if one allows low attachment of *nur* when in preverbal position, it should also be possible to have low attachment when the constituent is not moved. This, however, would have the consequence that it cannot be ensured that *nur* always evaluates all the alternatives to its left in wh-questions either. I.e., the explanation of intervention effects vanishes.[31]

[31]Beck (2006) is seemingly aware of this fact, as she notes in her footnote 7 that she assumes a syntax for *nur* inspired by Jacobs (1983) and Büring and Hartmann (2001). These authors assume that *nur* always attaches to clausal nodes. This way intervention effects follow necessarily. Then it must, however, be stipulated that association

(132) Nur in HAMBURG hat der Hans eine NEUE Idee vorgestellt
only in Hamburg has the Hans a new idea presented
'Hans presented a new idea only in Hamburg, and in all other places he presented an old idea.'

#'Hans only presented a new idea in Hamburg, and he did not present any idea whatsoever in any other place.'

4.7.2 Chierchia's approach to NPI-licensing and intervention effects

The present theory is indebted to the approach to intervention effects discussed in Chierchia (2004, 2006). Because of this I want to briefly discuss it. Before doing so, though, I must provide some necessary background, as the proposal is mainly concerned with the distribution of NPIs.

NPI-elements like *any* must appear in DE-environments (cf. Fauconnier (1975), Ladusaw (1979)), as is well-known:[32]

(133) John didn't see any student today

(134) *John saw any student today

Linebarger (1981) shows that certain elements can cause an intervention effect. In particular, if a universal quantifier intervenes between the DE-element and the NPI, unacceptability results.

(135) *It is not the case that everyone has any potatoes

Chierchia (2004, 2006) suggests the following theory for NPI-licensing. NPI *any* has the same meaning as the existential quantifier *some* with the addition of activating smaller domain-

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by preverbal *nur* in (132) with *neue* is blocked for some other reason. The issues surrounding *nur* is complicated by the fact that such a theory would also have to give up the V2-analysis of German. It must therefore be left for future research to determine whether this is the right approach. But (132) casts further doubts on the semantic theories of intervention effects discussed in this subsection.

[32]There are certain well-known issues arising with respect to this generalization, which need not concern us here. In particular, there is a distinction between strong NPIs and weak ones. First, the latter are not licensed by certain DE-elements (Zwarts 1998). Second, elements like *only* do not license strong NPIs (cf. von Fintel (1999)). For both issues see Gajewski (2008).

alternatives. This means that our entry for wh-expressions is parallel to the one for NPIs argued for by Chierchia. NPI *any* comes with a certain domain D in its ordinary value. In its alternative value, subsets of D are activated. Chierchia assumes that the exhaustive operator O_{Alt} associates with D, i.e., it checks the felicity of placing an NPI in a certain environment. Thus the ungrammatical (134) has the LF in (136) associated with it. For the semantics of O_{Alt} assume that it is similar to *only* with the only difference being that it asserts rather than presupposes that the prejacent is true, (137). Assume again that p is the denotation of the prejacent ϕ.

(136) O_{Alt} [$_{IP}$ any student 1[John saw t_1]]

(137) $[\![O_{Alt}]\!](g(C))(p)(w) = 1$ iff $p(w) = 1 \wedge \forall q \in g(C)[q(w) = 1 \rightarrow p \subseteq q]$
if $g(C) \subseteq [\![\phi]\!]^{Alt}$, otherwise undefined

When we put these ingredients together, the semantic computation in (138) results. Note in particular that the denotation of C is set identical to the alternative value of IP (138b). When these alternatives are factored into the meaning of the sentence, the denotation in (138c) is the consequence. Assuming that D = $\{a, b, c\}$, (138c) can be paraphrased as 'John saw a student in the domain $\{a, b, c\}$ and for all alternatives with domains smaller than $\{a, b, c\}$, that alternative must be false'. This statement, however, is contradictory. We already know that singleton domain alternatives, for instance, are strictly stronger than the ordinary value of IP. But if John saw a student from $\{a, b, c\}$ it must be the case that at least one of the singleton domain alternatives is true, as well. Thus the truth conditions in (138c) can never be fulfilled, and ungrammaticality is the consequence. It is easy to see why (133) is grammatical under this approach. The DE-negation reverses the entailment patterns. Thereby it becomes possible that the ordinary value of IP is true, as it is the strictly strongest proposition in the alternatives, whereas all other alternatives are false.

(138) a. $[\![\text{IP}]\!]^g = \lambda w.\exists x \in D[student_w(x) \wedge see_w(John, x)(w)]$

b. $g(C) = \{\lambda w.\exists x \in D'[student_w(x) \wedge see_w(John, x)] \mid \emptyset \neq D' \subseteq D\}$

c. $[\![(136)]\!]^g(w) = 1$ iff $\exists x \in D[student_w \wedge see_w(John, x)] \wedge$
$\forall p \in g(C)[p(w) \rightarrow \lambda w'.\exists x \in D[student_{w'}(x) \wedge see_{w'}(John, x)] \subseteq p]$

What about the intervention effect in (135)? Chierchia argues that the ungrammaticality of such examples is due to an implicature triggered by the universal quantifier. In this respect, his assumptions are fully parallel to the ones made in the present analysis to account for the slight markedness of wh-questions with intervening UE-indefinites. Chierchia assumes the LF in (139) for the ungrammatical (135). Notice that there are two exhaustive operators in the structure. The lower one is responsible for the scalar implicature by the universal quantifier, whereas the higher one checks whether NPI *any* is placed in the correct semantic environment.

(139) O_{any} [$_{CP}$ O_{scalar} [$_{IP}$ not everyone 2[any potatoes 1[t_2 has t_1]]]]

Without going into too much detail, the intervention effect is accounted for in the following way: The universal quantifier is in a DE-environment. Thereby a scalar implicature to the effect that 'someone has any potatoes' comes about. Notice that the NPI is not in a DE-environment in this scalar implicature. Thereby the explanation for the ungrammaticality of (134) carries over to the intervention effect example.[33]

It should be clear from this brief sketch that the present proposal is inspired by Chierchia's. The two theories are also compatible with each other. What the two analyses share is that intervention effects come about if a wh-expression or NPI is in the scope of an operator that manipulates the semantic environment in such a way that the expression is not licensed anymore.

[33](135) would not be ungrammatical without the scalar implicature. To see this assume there are two individuals $\{a, b\}$ and three potatoes $\{c, d, e\}$. According to the LF in (i) the truth conditions in (ii) obtain. This has the consequence that there must be some individual such that he doesn't have a potato in D and for all alternatives it must be the case that they are false, if not entailed by the assertion. If b has no potato in D, it also follows that he does not have any in D'. I.e. *any* should be licensed.

(i) O_{Alt} [$_{IP}$ not everyone 2[any potatoes 1[t_2 has t_1]]]

(ii) $[\![(i)]\!]^g(w) = 1$ iff $\neg\forall y.\exists x \in D[potato_w(x) \wedge has_w(y, x)] \wedge$
$\forall p \in g(C)[p(w) \rightarrow \lambda w'.\neg\forall y.\exists x \in D[potato_{w'}(x) \wedge has_w(y, x)] \subseteq p]$

The present theory can easily adopt Chierchia's approach to NPI licensing and the latter can adopt the former's approach to intervention effects in wh-questions. Moreover, this perspective gives support to the idea that wh-expressions introduce domain alternatives in the first place. In particular, wh-words and NPIs in Chinese are expressed by the same lexical elements (Liao 2010). It is therefore not too surprising that both NPIs and wh-expressions make use of domain alternatives. The only special feature of German wh-expressions is then that they must be checked by an operator different from the one used for NPIs, namely the Q-operator. Obviously, this can be specified lexically.

Adopting Chierchia's proposal is attractive because it potentially unifies intervention effects found with wh-questions and those found with NPI-constructions. If Chierchia's approach should turn out to be wrong, this does not necessarily mean that the present theory is doomed, as well. It would, however, make it difficult to find a unified account of intervention. Guerzoni (2006) argues for a syntactic solution to intervention with both NPIs and wh-expressions: NPIs undergo feature checking at LF with a DE-head, and wh-elements must check a feature with the Q-head. Following Pesetsky (2000), features can be checked by two mechanisms, namely via QR or via feature movement. Only the latter is blocked by interveners, whereas QR is not. Although this proposal does not explain intervention effects as such, it makes certain interesting predictions for intervention effects with NPIs. In particular, such intervention effects should only arise in cases where QR is blocked and the feature can only be checked through feature movement. This prediction is born out as examples show where QR from subject position is impossible. In this case only feature movement can license the NPI. Guerzoni shows that the universal quantifier in 2 causes intervention. Here the NPI is in subject position and by assumption cannot QR. In (141), on the other hand, no such degradedness arises because the NPI is in object position. Thereby its ability to move covertly is not suppressed.

(140) a. The secretary didn't tell me that anybody called.

b. *The secretary didn't tell everybody that anybody called.

(Guerzoni 2006:370)

(141) The secretary didn't tell everybody that she called any student.
(Guerzoni 2006:370)

However, we note that no such effect is detectable with German wh-in-situ expressions. Both (142) with the wh-expression in subject position and (143) with the wh in object position are uninterpretable. Note that in (142) and (143) I am using the so-called wh-scope marking construction. Beck (1996a) shows that this construction is also subject to intervention.

(142) *Was glaubt niemand wen der Karl gesehen hat?
what thinks nobody who.ACC the.NOM Karl seen has

(143) *Was glaubt niemand wer den Karl gesehen hat?
what thinks nobody who.NOM the.ACC Karl seen has

Therefore it is unlikely that Guerzoni's approach and the present one are compatible. I will therefore continue to assume that Chierchia's theory is best suited if one is to attempt a unified theory of intervention effects. Obviously, though, the latter theory does not offer an explanation for the difference in acceptability between 2 and (141).

4.8 Conclusion and outlook

The present chapter has shown a new way to deal with intervention effects in German wh-questions. I argued that such effects arise if the question denotation does not match the alternatives that the speaker who utters the question has in mind. More concretely, I assumed that the Q-operator requires that the disjunction of the propositions in the question denotation is equivalent to the denotation of the sister constituent of Q. The latter is supposed to reflect the alternative space that the speaker of the question has in mind. Therefore if the actual alternatives provided by the question do not reflect this alternative space, ungrammaticality results. In general, the propositions in the question denotation must be ordered by disjunction. I implemented this idea making crucial use of domain alternatives in the sense of Chierchia (2004, 2006). This explanation of intervention effects is formally simple, and it was shown that it draws the line

between potential interveners and non-interveners more or less correctly. But recall the potential complications raised by some data in subsection 4.6.3. This must be left for future research. Moreover, it has been shown that the present account is empirically and also theoretically superior to some competitor analyses which also attempt to derive intervention effects semantically. Interestingly, the present approach makes it possible to unify intervention effects arising with NPIs and those in wh-questions if Chierchia's theory for the former is adopted in addition to the present one.

A possible avenue for further research would be a comparison between the present proposal and Szabolcsi and Zwarts (1992). These authors deal with weak-island phenomena and try to derive them in a semantic system. Their analysis intuitively seems to be related because they also make use of the assumption that domains must be ordered in a certain way so that a question is interpretable. In particular, disjunction (or rather union) does play a role for them when dealing with weak islands. Moreover, the fact that the present analysis does not rely on movement of the wh-in-situ expression in order to derive the intervention effect makes it even more possible that the two phenomena are related. So far it is not clear to me, however, how the two systems relate to each other exactly. In particular, the following problem seems to arise: Weak islands are subject to obviation by modals as shown by Fox and Hackl (2006) (also cf. Abrusán (2007), Abrusán and Spector (2010)). As shown by the authors cited, this obviation cannot be accounted for in Szabolcsi and Zwarts's 1992 analysis, which is problematic. Intervention effects, however, are not subject to obviation by modals. This state of affairs makes it difficult to decide whether the two phenomena should be treated on a par or not.

Chapter 5

Generalized Scope Economy and scalar implicatures (partly based on joint work with Benjamin Spector)

5.1 Introduction

The present chapter has two objectives: First, it wants to show that certain inverse scope interpretations in quantifier-scope constructions are not available. In particular, if the reading resulting from inverse scope is strictly stronger than the surface scope reading – that is, the former asymmetrically entails the latter –, then the scope shifting operation necessary to generate the inverse scope is blocked. Second, an explanation is given for these facts that relies on the theory of scalar implicatures. It is argued that the surface scope and the inverse scope structures form alternatives. The strengthened interpretation of the surface scope structure then will state that its alternative – that is, the inverse scope interpretation – is false, if the latter is strictly stronger than the former. If the theory proposed in this chapter is correct, this gives support to

the view that language use is guided to some extent by logical principles. Indeed, the extent to which it is driven by these principles is quite surprising. I will now give an introduction to both parts in more detail.[1]

5.1.1 The Generalized Scope Economy Condition

Fox (1995, 2000) has shown that covert scope shifting operations (CSSO) such as QR and reconstruction (or quantifier lowering) are constrained by economy considerations. That is to say, a CSSO only applies, if the semantic interpretation resulting from the structure after the application of that CSSO is different from the one had the CSSO not applied. The way this is stated is as follows:

(1) *Economy condition on scope shifting (Scope Economy)*
OP can apply only if it affects semantic interpretation (i.e., only if inverse scope and surface scope are semantically distinct) *(where OP stands for CSSO; C.M.)*
(Fox 2000:21)

This means that a CSSO can apply in (2), but not in (3). Syntactic wide scope for the universal quantifier with respect to *John* in (2) results in an interpretation that is not different from the one where the universal takes narrow scope. According to (1) the grammar does not even generate the structure that would correspond to syntactic wide scope. In (3), on the other hand, giving wide scope to the universal quantifier over the modified numeral does result in a structure that leads to a different interpretation, as is well-known. By (1) the structure corresponding to the wide scope interpretation is licensed and can be generated by applying the necessary CSSO.[2]

[1] Parts of this chapter are based on joint work with Benjamin Spector (Mayr and Spector to appear). In particular, the empirical sections 5.2 and 5.3, as well as subsections 5.4.1 and 5.5.2. Of course, all mistakes in the material put forward lie solely with the author, and my co-author need not necessarily agree with the overall theoretical implementation as such.

[2] It is clear that something more sophisticated must be said in order to rule out that (2) really does not have an LF, where the universal quantifier takes wide scope. Fox does exactly that by using the parallelism condition on VP-ellipsis as a diagnostic tool which we will also apply in subsection 5.3.2.1 for our own purposes. Note also that obligatory QR of the quantifier for type reasons in (2) is not affected by (1), i.e., *every girl* may actually QR over the verbal predicate, but never over *John*.

(2) John danced with every girl

(3) (At least) one boy danced with every girl

Fox's claim has far-reaching consequences for the architecture of the grammar. In the present chapter, we discuss data that lend further support to Fox's observations. But moreover, it is argued that the the principle of Scope Economy in (1) should be generalized in the following way: A CSSO can only apply if the interpretation of the outcome structure is weaker than the interpretation of the input structure, where reading R_1 is weaker than R_2 if and only if R_1 does not entail R_2. We formulate this as the *Generalized Scope Economy Condition* (GSEC) as in (4). GSEC incorporates the cases subsumed under Fox's Scope Economy condition, but moreover disallows CSSOs that lead to readings that asymmetrically entail the input reading. In other words, we claim that inverse scope structures whose interpretation would asymmetrically entail the surface scope interpretation or would be equivalent to it are not generated by the grammar.

(4) *Generalized Scope Economy condition*
A CSSO cannot apply if the meaning of the resulting scope is equivalent to or stronger than (i.e. entails) the meaning of the surface scope.

We show that (4) explains various complicated scope facts. In particular, we show in section 5.2 that it accounts for the unavailability of certain readings in sentences with more than one scope-bearing expression. Moreover, we adduce new data which show that upward-entailing (UE) indefinites and downward-entailing (DE) indefinites differ with respect to their scope possibilities. GSEC straightforwardly accounts for this.

In section 5.3 we discuss a potential counterargument to our claim. In short this counterargument says that inverse scope readings that entail the surface scope readings can never be detected by a speaker. There is a pragmatic principle which states that if the surface scope reading of a sentence is true in a given situation, the sentence must be judged as true, i.e., the inverse scope reading is inaccessible. We will discuss this potential problem using Meyer and Sauerland (2009) as our point of departure. We agree with this criticism and therefore proceed

to show that the GSEC is nevertheless needed for a descriptively adequate theory. In particular, we suggest that the GSEC is needed in addition to the pragmatic principle just discussed. We give three arguments that address the issues raised by the pragmatic principle. Following the logic of Fox's original argument, we use examples with VP-ellipsis to justify our claim that certain scopal readings are indeed not generated by the grammar. Second, we show that stronger readings can in fact be detected contra the claim of the pragmatic principle discussed. In particular, DE-environments provide the basis for such an argument. Lastly, we will consider cases where the weaker reading is pragmatically deviant. In such a situation, the stronger reading should become detectable according to the preference for truth hypothesis. We show that the reading corresponding to the stronger interpretation, however, is not available either and therefore as our theory predicts not generated by the grammar.

In section 5.4 we will discuss two systematic exceptions to our theory. We will see that these exceptions support the GSEC under closer scrutiny. First we look at quantifiers at the right edge, which under certain circumstances do not follow the GSEC and therefore cannot be accounted for by the theory of implicatures either. We suggest that these examples are such that the quantifiers are free to undergo *overt* string-vacuous rightward movement and the input to the strengthening process is therefore not the surface scope representation. Second, we will look at the scopal interactions between quantifiers and modals. We find that modals do not always conform to our hypothesis. Two possible routes of addressing this issue are suggested.

In section 5.5 we discuss some further properties of the present approach. In particular, our theory makes it possible that new scope possibilities arise in DE-environments. We will see that this is indeed the case. Third, we briefly address the question of wide-scope indefinites. Indefinites that can take wide scope without undergoing QR provide a different input for the strengthening process than modified numerals. Because of this the latter do not allow wide scope as freely as the former.

5.1.2 Scalar implicatures interacting with scope shifting

The second part of the chapter tries to account for the facts covered by the GSEC by using the theory of scalar implicatures. I.e., in this part it is tried to reduce the GSEC to independently motivated principles. In particular, I will argue for the generalization in (5) where by strengthened meaning of the surface scope I mean the surface scope interpretation with its scalar implicatures factored into the meaning.

(5) *Blocking by Scalar Implicature*

A CSSO cannot apply if the strengthened interpretation of the surface scope entails that the inverse scope interpretation must be false false.

The rationale to be explained below in more detail is the following: A hearer of a potentially scopally ambiguous sentence entertains both the surface scope and the inverse scope representations as possible LFs. Moreover, she assumes the surface scope interpretation to be true by default. Because of this the scalar implicatures associated with the surface scope are automatically factored into its meaning. If the strengthened surface scope interpretation entails that the inverse scope interpretation must be false, the latter is disregarded for further computation. In other words, the theory of scalar implicatures is suggested to be used as a device to minimize ambiguity.

In section 5.6 I will give some background on how scalar implicatures associated with quantifiers are derived under the assumption that scalar items are organized in sets of alternatives which are used for conversational reasoning. In the following section it is shown how a theory of scalar implicatures would account for the relevant facts covered by the GSEC. In section 5.8 it is asked whether it is conversational reasoning that derives scalar implicatures of rather a more direct grammatical approach. I.e., is a pragmatic or a grammatical approach better suited to explain the facts? It is argued that the fact that scalar implicatures have an effect on which syntactic structures are generated leads us to assume that scalar implicatures are derived in the semantic component through a syntactically present exhaustivity operator. In this we follow

Chierchia (2006), Chierchia et al. (2008), Fox (2007). Section 5.9 concludes the paper.

5.2 Complicated scope facts

In this section, we discuss two sets of data where surprisingly scope ambiguities are missing. In both cases, the GSEC predicts the absence of the LFs which would be necessary to generate the unavailable interpretations.

5.2.1 Interaction between quantifiers and negation

As is well known, (6) is ambiguous depending on the mutual scope of the quantifiers. This ambiguity is traditionally analyzed by having the universal quantifier undergo QR (May 1985) or by having some equivalent mechanism in the grammar that generates the correct interpretation such as quantifier storage (Cooper 1983) or Montague's 1974 quantifying-in rule. In what follows, we will assume that there is a transparent syntax-semantics mapping. That means that the wide-scope interpretation is generated by the syntax, i.e., there is a movement rule QR that lets the universal quantifier c-command the indefinite at LF. Wide scope in the syntax directly translates into wide scope in the semantics if the usual entries for quantifiers are assumed.

(6) A student of mine met every professor ($\exists > \forall$) ($\forall > \exists$)

But now consider the following pair of sentences. (7) is ambiguous in the same way as (6) is. We assume that the universal quantifier in this case undergoes optional reconstruction to its base-position (Fox 2000), as negation does not undergo QR. That means that the universal quantifier can be optionally interpreted in its VP-internal position inside the scope of negation. (8), on the other hand, is not ambiguous (Beghelli and Stowell 1997). The universal quantifier cannot have wide scope with respect to negation. The only difference to (7) is that we have changed the surface scope of the scope-bearing elements involved, but crucially the types of elements involved are the same.

(7) Every student of mine didn't show up $(\forall > \neg)\ (\neg > \forall)$

(8) John didn't meet every student of mine $(\neg > \forall)\ *(\forall > \neg)$

This is puzzling, because we know independently that quantifiers in object position must undergo obligatory QR for type reasons – that is, in order to allow for the predicate of type $\langle e\langle et\rangle\rangle$ denoted by the verb to combine with the quantifier of type $\langle\langle et\rangle t\rangle$ by functional application the quantifier has to raise above the trace position of the subject. Once the quantifier has raised it can take the derived predicate as its argument.[3] So, if the universal quantifier does raise, why can't it take scope over the negation?

Beghelli and Stowell (1997) also observe that narrow scope of the indefinite in (9) with respect to negation is difficult to obtain. (9) differs minimally from (7) in that the universal subject is replaced by an indefinite. Reconstruction seems impossible.

(9) A student of mine didn't show up $(\exists > \neg)\ ??(\neg > \exists)$

We want to suggest that the unavailable interpretations in (8) and (9) are ruled out by the GSEC.[4] But consider first (6) and (7) again. In order for a scope ambiguity to obtain in these cases, it must be the case that the interpretation corresponding to the inverse scope does not entail the surface scope interpretation. This is clearly the case. In (6) the inverse reading is true if for

[3]There are, of course, other ways of getting the correct semantic composition. A type-shifting operation, for instance, leads to similar results. In event semantics the object quantifier can directly combine with the verbal predicate, because the argument slot for the subject argument is introduced by a separate syntactic head (Kratzer 2003). These disputes are tangential to the present argument.

[4]The argument only goes through, if quantifiers presuppose that their restrictor is non-empty. That is, quantifiers are assumed to be Aristotelian. This assumption is controversial for indefinites, as Irene Heim (p.c.) reminds me. For instance, non-emptiness of the denotation of the restrictor in (i) would contradict the assertive part on its surface scope interpretation, i.e., (i) would be undefined when the surface scope representation is chosen. Because of this, however, the inverse scope interpretation does not asymmetrically entail the surface scope interpretation in that particular situation. In other words, the CSSO necessary for the inverse scope representation should be licensed.

(i) A solution was never found.

If one does not want to commit oneself to the view that quantifiers presuppose their restrictor to be non-empty, one can as well stipulate that the GSEC involves a non-standard notion of entailment, whereby ϕ is said to entail ψ whenever every model of ϕ in which the relevant restrictors are not empty is also a model of ψ.

every professor there is a potentially different student who met him. This does not entail that there is one student who met every professor, as required by the surface scope reading. The inverse scope interpretation in (7) requires that there is a student of mine who didn't show up, which does not entail that no student of mine showed up, as the surface scope interpretation would have it. In both (6) and (7) the interpretation of the surface scope asymmetrically entails the interpretation resulting from the CSSO. Thus the GSEC correctly predicts the two sentences to be perceived as ambiguous.

(8) and (9), on the other hand, do not allow a CSSO to apply, as the GSEC would be violated. In the former the truth conditions of inverse scope require that John didn't meet any student of mine, which entails the truth conditions associated with surface scope that there is a student of mine who John didn't meet. Moreover, it is easy to see that if the surface scope is true – that is, if there is a student who John didn't meet – the inverse scope requirement that John didn't meet any student of mine is not necessarily met. I.e., the inverse scope interpretation asymmetrically entails the surface scope interpretation. Because of this the GSEC correctly prohibits the LF corresponding to the inverse scope reading.

(9) does not allow inverse scope, because its reading entails the LF without CSSO. If no student showed up, as the inverse scope dictates, then the surface scope reading is automatically true, because it must be the case that there is a student who didn't show up. The reverse pattern, however, does not hold. If there is a student who didn't show up, it does not follow that no student showed up. Again, the inverse scope interpretation asymmetrically entails the surface scope interpretation and is therefore blocked by the GSEC.

These well-known data lend first circumstantial support to our claim that a principle like the GSEC is part of grammar. GSEC predicts that the sentences (8) and (9) should be perceived as unambiguous. Let us now turn to some new facts.

5.2.2 Contrasts between UE-indefinites and DE-indefinites

In the preceding subsection we have seen that quantifiers show differing behavior in their ability to scope below or above negation. We claimed that this follows from the GSEC. Negation is

a DE-element. We therefore expect to find different scope possibilities for UE-indefinites and DE-indefinites.[5] This is indeed the case. The pairs in (10a)-(10b), (11a)-(11b), (12a)-(12b), and (13a)-(13b) exemplify our observation. The (a)-examples have an UE-indefinite in subject position. In all cases the UE-indefinite c-commands a universal quantifier. The (b)-examples differ minimally in that the UE-indefinite is replaced by a DE-one. The (a)-examples allow for an inverse scope reading, whereas the (b)-examples do not. The continuations in brackets force the narrow scope reading for the subject quantifier. This leads to unacceptability in the (b)-cases.

(10) a. More than three students are certain to pass, (i.e., it's certain that at least four pass) (more than 3 > certain) (certain > more than 3)

b. Fewer than three students are certain to pass, (#i.e., it's certain that at most two pass) (fewer than 3 > certain) *(certain > fewer than 3)

(11) a. Many windows are always open in this building (i.e., it is always the case that few are closed) (many > always) (always > many)

b. Few windows are always open in this building (#i.e, it's always the case that most are closed) (few > always) *(always > few)

(12) a. A boy heard every girl sing $(\exists > \forall)$ $(\forall > \exists)$

b. Few boys heard every girl sing (few > $\forall$) *($\forall$ > few)

(13) a. Somebody is bound to be there $(\exists > \Box)$ $(\Box > \exists)$

b. Nobody is bound to be there $(\neg\exists > \Box)$ *$(\Box > \neg\exists)$

(Kayne 1998:139)

[5]Let us define generalized entailment as in (i) and DE- and UE-entailingness as in (ii), as is standardly done:

(i) For A and B of type $\langle\tau, t\rangle$ and any $a_1, ..., a_n$ of type τ, $A \subseteq B$ iff $A(a_1), ..., A(a_n) \subseteq B(a_1), ..., B(a_n)$.

(ii) a. Function f is UE iff for any a and b, where $a \subseteq b$, $f(a) \subseteq f(b)$.
b. Function f is DE iff for any a and b, where $a \subseteq b$, $f(b) \subseteq f(a)$.

The fact that only UE-indefinites, but not DE-indefinites allow for inverse scope in the configurations above, follows from the GSEC.[6] Consider (10a)-(10b) for concreteness. First, assume the following situation for (10a): There are 10 students in a class. For more than three students it is sure that they pass. In such a situation the surface scope reading is true. Moreover, it is true that the inverse scope reading is true as well, because if there are more than three specific students who are certain to pass, it must be certain that more than three students pass. Now assume another situation: There are 10 students in a class, again. This time it is sure that out of these more than three will pass, but we don't know which ones. The inverse scope reading is true in this situation, but the surface scope interpretation is not necessarily so, because as far as we know any of the students might be among the ones who do not pass. I.e., the surface scope reading asymmetrically entails the inverse scope interpretation and therefore the latter is weaker than the former. The corresponding LF is licensed by the GSEC.

Now consider (10b) under a situation with 10 students, where there are two students of who we are sure that they will pass. The surface scope interpretation is true, but not necessarily the inverse scope interpretation. In particular, the situation is compatible with actually four students passing, which would prohibited by the inverse scope interpretation. On the other hand, if the situation is such that it is certain that no more than two students will pass, the inverse scope reading is true and the surface scope one is as well. This is so, because if it is certain that fewer than three will pass, it cannot be the case that more than two students are such that they are certain to pass, i.e., it must be the case that fewer than three are such that they are certain to pass. This means that the interpretation of the LF with CSSO asymmetrically entails the reading of the one without CSSO. Thus the GSEC does not allow the former to be generated. The missing reading is accounted for.

The other examples function completely in parallel. The generalization is as follows: A UE-indefinite can be assimilated to an existential quantifier ranging over its so-called 'witness-sets' (cf. Barwise and Cooper (1981)). Hence the relevant ambiguity in all the (a)-examples above

[6]The following argument only holds under the *de re* interpretation of the restrictor of the property *students*. See section 5.4.2 for discussion what happens when *de dicto* interpretations are taken into account.

is reducible to an ambiguity in the relative scope of a universal quantifier and an existential quantifier. Given that the reading where the universal quantifier scopes over the existential quantifier is the weaker reading, it is not ruled out by the GSEC, i.e., inverse-scope is predicted to be possible. In contrast with this, a DE-indefinite is equivalent to the negation of a UE-indefinite. That is, the relevant readings in cases involving a DE-indefinite can be schematically represented as in (14). The inverse scope reading (14b) a-entails the surface scope reading in (14a).

(14) a. Surface scope: $\neg\exists x.\forall y[P(x,y)]$

b. Inverse scope: $\forall y.\neg\exists x[P(x,y)]$

So far the GSEC seems to make the right predictions. Notice, however, that the argument given so far has a potential weakness. In the relevant examples, the situations that make the stronger readings with CSSO true are proper subsets of the situations that make the weaker ones without CSSO true. That means that if a stronger reading is true, the weaker one is automatically true as well. Therefore the question arises how we can be sure that the stronger reading is really absent. Maybe we only have access to the weaker reading in such cases. This would mean that we cannot conclude that the LFs for the stronger readings with CSSO are not generated. We address this issue in the following section.

5.3 Preference for truth?

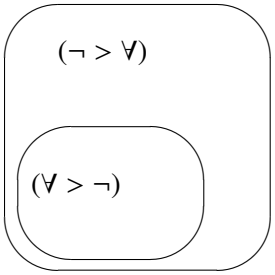
5.3.1 Truth Dominance

Consider the unambiguous sentence (8) repeated as (15). We claimed that the inverse scope reading is absent, because the GSEC does not license the necessary CSSO.

(15) John didn't meet every student of mine $(\neg > \forall)$ $*(\forall > \neg)$

The sentence (15) is such that the inverse scope reading asymmetrically entails the surface scope reading. This means that in every situation under which the inverse scope reading is true, the surface scope reading is true as well, i.e., the situations that make the former true are a proper subset of the situations that make the latter true, as the Venn diagram in (16) depicts:

(16)



To be more precise, consider two situations for (15), given in (17). The surface scope reading is true in both situation 1 and situation 2: First, if there is one student that John didn't meet, it follows that it is not the case that he met every student. Second, if John didn't meet any of the students, it again follows that it is not the case that he met all of them. The inverse scope reading, on the other hand, is only true in situation situation 2. It is not true in situation 1, because if there is one student John didn't meet, it does not follow that he didn't meet any of them. But this is of course precisely what situation 2 requires. And so the inverse scope reading is true in that case. This argument just repeats what was established in the previous section: The inverse scope reading asymmetrically entails the surface scope reading in the case of (15).

(17) a. *Situation 1*: There are four students of mine. There is one student John didn't meet.

b. *Situation 2*: There are four students of mine. John didn't meet any of them.

But this is a potential drawback for our account. Since the inverse scope reading is included in the surface scope reading, as it were, how can we ever be sure that (15) – and with it all the other examples that we took to support our theory – really lacks the inverse scope reading? And by extension we have to ask whether the associated structure is really not generated by the

grammar.

Meyer and Sauerland (2009) make a claim along these lines (also cf. the discussion in Reinhart (1997) and Abusch (1994)). They propose a pragmatic principle that says the following: A speaker judges an ambiguous sentence to be true as soon as it is true under one salient reading. The salient reading in our case would be the surface scope reading, as it is the one that is available without any doubt. When we apply this reasoning to our case in (15), it follows that the surface scope reading is directly accessible by a speaker. The inverse scope interpretation, on the other hand, asymmetrically entails that reading. It is therefore included in the surface scope interpretation, i.e., if the latter is true in a given situation, the speaker will judge the sentence true. The stronger reading as such is therefore undetectable, but it might be generated by the grammar. That means (15) should appear to be unambiguous, but it really is not. Meyer and Sauerland (2009) formulate this idea as follows, calling the pragmatic principle *Truth Dominance*.

(18) *Truth Dominance*: Whenever an ambiguous sentence S is true in a situation on its most accessible reading, we must judge sentence S to be true in that situation.
(Meyer and Sauerland 2009:140)

One might now think that Truth Dominance or a similar pragmatic principle is the reason why we do not perceive the one interpretation of (15) that necessitates a CSSO.[7] But if this were true, the GSEC as a principle of grammar would be in danger. Recall that pragmatic accounts such as the one just sketched leave it open whether the accompanying structure responsible for the inverse scope interpretation is generated or not by the grammar in cases such as (15). All they claim is that speakers do not have direct access to these readings.

[7]Gualmini et al.'s 2008 Principle of Charity is clearly related to the present discussion. Note, however that the Principle of Charity does not make reference to the notion of a most accessible reading.

We think that this line of reasoning is entirely plausible.[8] This is to say, we agree that it is possible that some ambiguities cannot be detected due to a principle along the lines of Truth Dominance. Nevertheless we want to claim that GSEC is needed. To do so, we have to become clear what kind of evidence is needed to assure ourselves of GSEC as part of the grammatical system. First, we must show that the LFs that would be needed for inverse scope are in fact not generated by the grammar. If we can find evidence that they are not generated, this is an argument for the GSEC. Truth Dominance, on the other hand, allows for these LFs to be generated. This is done in the following subsection. None of the arguments given is an argument against Truth Dominance as such, of course.

5.3.2 Refutation of the counterargument

5.3.2.1 The parallelism condition on VP-ellipsis

As a first additional argument for the GSEC we consider cases of scope shifting in VP-ellipsis constructions. We argue that they provide rather direct evidence that CSSOs that lead to strictly stronger interpretations are ruled out by the grammar.

First it must be noted that we find ourselves in a situation similar to the one Fox (1995, 2000) found himself in. Recall that Fox wants to account for the principle of Scope Economy (1), which is weaker than GSEC and says that a CSSO is licensed if and only if the resulting reading is different from the one had the CSSO not applied. The principle of Scope Economy also could

[8] In this context it must be noted that even though we will argue that the GSEC is needed, this does not mean that we necessarily disagree with Meyer and Sauerland's 2009 argument for Truth Dominance. On the basis of their principle they argue against Büring and Hartmann's 2001 and Reis's 2005 conclusion that German does not have DP-level *nur 'only'*. The following example, where the object *Maria* is topicalized is unambiguous. Both Büring and Hartmann (2001) and Reis (2005) claim that reconstruction of the object together with *only* is impossible, because they do not form a constituent. Meyer and Sauerland (2009) claim that no such conclusion can be drawn and that Truth Dominance accounts for the perceived non-ambiguity. We do not want to side with anyone, but want to point out that GSEC does of course explain the absence of the inverse scope reading as well.

(i) **Nur** MARIA liebt jeder t_{object}
only Mary loves everyone-NOM
Only Mary is loved by everyone.
NOT: Everyone loves only Mary.
(Büring and Hartmann 2001:260)

not be argued for on the basis of pure introspection, i.e., by looking at scope ambiguities or the absence of scope ambiguities of simple sentences. Fox adduced data such as the ones in (19) and (20) to give support to Scope Economy. Such data were originally discussed by Sag (1976) and Williams (1977). (19) shows scope ambiguity as expected. But the authors cited notice that the same sentence when used in a discourse with VP-ellipsis is unambiguous (20) (data cited from (Fox 2000:30)).

(19) A boy admires every teacher. $(\exists > \forall)$ $(\forall > \exists)$

(20) A boy admires every teacher. Mary does, too. $(\exists > \forall)$ $*(\forall > \exists)$

We notice that a VP can be elided if (21), the so-called parallelism constraint on VP-ellipsis, holds.[9]

(21) *Parallelism*

A VP in sentence *B* can be elided, if the scopal relations between scope-bearing elements in the antecedent sentence *A* and *B* are parallel.

Let us see how (21) and Scope Economy are applied to (19) above. First, we notice that the inverse scope reading in the ellipsis sentence is identical to its surface scope reading. Therefore scoping the universal quantifier over *Mary* would violate Scope Economy and is therefore prohibited. But this has the consequence that by parallelism (21), the parallel CSSO in the antecedent sentence is blocked as well. Otherwise the scope relations in the antecedent and the ellipsis sentence would not be parallel anymore. Therefore Scope Economy plus the principle of parallelism together straightforwardly predict the absence of ambiguity.

This makes the prediction that (22) should exhibit scopal ambiguity, as it indeed does. Why? The inverse scope interpretation of the ellipsis sentence is different from the surface scope interpretation, i.e., Scope Economy allows the required CSSO. By parallelism the antecedent

[9]Notice that the formulation in (21) is stronger than one might initially expect. In particular, it requires that the scopal relations for the complete sentences are parallel and not just the ones in the VPs. We return to this issue below.

sentence must have inverse scope as well if the ellipsis sentence has it.[10]

(22) A boy admires every teacher. A girl does, too. (∃ > ∀) (∀ > ∃)

We can use Fox's structure of argument to test whether the GSEC in fact exists in grammar. Imagine a VP-ellipsis discourse where the antecedent sentence shows scope ambiguity when it appears on its own, just like in (19)-(20) above. Now if the inverse scope reading in the ellipsis sentence is stronger than the surface scope reading – that is, if the CSSO is blocked by the GSEC – then the CSSO in the antecedent should be blocked by parallelism. This means that the antecedent sentence should appear to be unambiguous. If we can find such examples, they would lend strong support to our claim that CSSOs that lead to a strengthening of interpretation are blocked by the grammar.

Notice what the situation just described would mean for Truth Dominance. An account that is based on Truth Dominance alone does not predict that the CSSO in the antecedent should be blocked. For such an account does not say that a strengthening CSSO is ruled out, but only that it is not detectable by mere inspection of the truth conditions of a sentence. But a CSSO in the ellipsis, even if undetectable as such, forces a parallel CSSO in the antecedent. In other words, according to Truth Dominance alone there should not be cases of VP-ellipsis where the antecedent sentence gets its scope fixed by a strengthening CSSO in the ellipsis sentence, because the LF necessary for the stronger reading is in fact generated by the grammar.

With this in mind consider the examples in (23). We notice that under the given context (23a) sounds fine, whereas (23b) is odd. The context provided is such that there cannot be a man who received and read every book. This in turn means that the surface scope reading is pragmatically odd for the antecedent sentences in (23a)-(23b), because it would say that there are more than five men who did read every book. This contradicts the context. The inverse scope reading saying that every book was read by more than five men, on the other hand, is allowed by the context.

[10]Note that the GSEC makes the same predictions for the data in (20) and (22) as can be easily verified. We leave this to the reader.

(23) *Context:* Preprints of several new books are sent to both male and female reviewers. No male reviewer received every book.

a. More than five men read every book. And more than five women did, too
#(more than 5 > ∀) (∀ > more than 5)

b. #More than five men read every book. However, fewer than five women did
#(more than 5 > ∀) *(∀ > more than 5)

Now consider the ellipsis sentences. The one in (23a) has an UE-indefinite in subject position. When the universal in the ellipsis site scopes over it (24b), the resulting reading is weaker than the surface scope interpretation (24a), and therefore the GSEC allows it: If there are more than five women who read every book, then every book is such that more than five women read it. By parallelism, the corresponding inverse scope reading is forced in the antecedent sentence. This is the one that is allowed by the context, and it is correctly predicted that (23a) should be a felicitous utterance.

(24) a. 'For more than five women it is the case that they read every book.'

b. 'For every book it is the case that more than five women read it.'

In (23b), however, the subject in the ellipsis sentence is DE. A CSSO would lead to a strengthened interpretation, as the inverse scope reading (25b) asymmetrically entails the surface scope reading (25a): If every book is such that fewer than five women read it, then there cannot be more than five women who read every book. Thus the GSEC rules out the inverse scope reading. Moreover, parallelism prohibits inverse scope in the antecedent sentence. But the surface scope reading of the antecedent is not licensed by the context, and (23b) is predicted to sound odd.

(25) a. 'For fewer than five women it is the case that they read every book.'

b. 'For every book it is the case that fewer than five women read it.'

(26) is a similar example.[11] The context makes sure that no person could have possibly watched every film shown at the festival. It follows that the surface scope reading of the antecedent sentence in both (26a) and (26b) should be infelicitous, because it would say that many critics are such that they watched every movie. The inverse scope reading, on the other hand, is licensed. The context allows every movie to be such that many critics watched it. The rest of the argument is parallel to above. (26a) has an UE-indefinite in the ellipsis sentence, i.e., QRing the universal quantifier above it leads to weakening and the GSEC licenses the CSSO. By parallelism the CSSO in the antecedent is licensed as well. (26a) is predicted to be good. In (26b), on the other hand, the ellipsis sentence has a DE-indefinite. A CSSO would strengthen the interpretation and the GSEC prohibits it. Parallelism then prohibits the CSSO in the antecedent sentence. Only the surface scope reading is possible in the antecedent, but this is the one that is not licensed by the context. Oddness results.

(26) *Context:* A film festival has parallel sessions. No one was able to watch every movie.

a. Still, many critics watched every movie. And a few ordinary people did, as well
#(many > ∀) (∀ > many)

b. #Still, many critics watched every movie. However, very few ordinary people did
#(many > ∀) *(∀ > many)

A parallel argument can be given for the oddness of (27). The surface scope interpretation of the antecedent sentence is false in the actual world, because it is not true that no Californian lives in LA. Thus the inverse scope interpretation should be triggered. The ellipsis sentence contains an indefinite and a negation. Applying reconstruction to the indefinite below negation results in an interpretation that is stronger than the surface reading: If is not the case that a New Yorker lives in LA, then it must be the case that some New Yorker doesn't live in LA. Since the resulting interpretation is stronger, it is blocked by the GSEC. This means that in the antecedent sentence parallelism only allows the surface scope interpretation, which we have seen to be infelicitous

[11] Thanks to Danny Fox (p.c.) for help with the construction of the example.

due to world knowledge.[12]

(27) #Every Californian doesn't live in LA, and a New Yorker doesn't either

#(∀ > ¬) *(¬ > ∀)

(28) below differs minimally. Here the ellipsis sentence contains a universal quantifier. Applying reconstruction does not violate the GSEC. The surface scope reading asymmetrically entails the inverse scope reading, because if every New Yorker doesn't live in LA, then it cannot be the case that all New Yorkers live in LA. I.e., scope shifting is licensed, and by parallelism also so in the antecedent. No oddness is predicted.[13]

(28) Every Californian doesn't live in LA, and every New Yorker doesn't either

#(∀ > ¬) (¬ > ∀)

The observations made in the present subsection are strong support for the view advanced in this chapter. CSSOs that lead to strengthened interpretations are blocked, i.e., the corresponding LFs are not generated. A theory that solely relies on a pragmatic principle like Truth Dominance cannot explain the data just discussed. In such a theory it should be possible to have LFs that

[12]Irene Heim (p.c.) notes that (i) is also infelicitous. The second conjunct in (i) expresses directly that there is no New Yorker who lives in LA. The corresponding surface LF must be something like (ii), where *neither* is split up into an additive part and negation. Now by parallelism it would be required that the inverse scope representation of the antecedent sentence in (i) obtains. The interpretation can be paraphrased as 'There is a Californian who does not live in LA'. It is reasonable to assume that the additive part of *neither* associates with focus on *New Yorker* parallel to *too* (cf. the discussion of the semantics of *too* in chapter 2, section 5). The presupposition of the ellipsis sentence is then that 'It is not the case that any *P* lives in LA' is true, with *P* some salient alternative to New Yorker. In the present case this would be the property *Californian*. The inverse scope interpretation of the antecedent sentence does not guarantee this, however. In particular, real world knowledge tells us that there are Californians living in LA. Therefore the presupposition of *neither* cannot be satisfied. This means the following: Parallelism forces inverse scope in (i) for the antecedent. But the presupposition associated with *neither* is not satisfied in this situation.

(i) #Every Californian doesn't live in LA, and neither does any New Yorker

(ii) additive [not [lives in LA any New Yorker$_F$]]

[13]Note that for (27) and (28) the argument rests on the assumption that it is the whole sentences that matter for parallelism, as stated in (21). I.e., it is not the scopal relations in the VPs alone that matter. This is so, because neither of the scope bearing elements is part of the elided VP. We follow Rooth (1992a,b), Tancredi (1992), Fox (2000) in this assumption. Also note that the difference in acceptability between (27) and (28) itself provides support for the particular formulation of parallelism in (21).

lead to strengthened interpretations, even if the pragmatic principle makes direct access to these readings difficult or impossible. Crucially, though, no restrictions on the scopal relations in the antecedent sentences of the VP-ellipsis cases discussed would be predicted. Let us now turn to a second direct prediction of the present theory.

5.3.2.2 When the weaker reading is pragmatically deviant

Recall the following empirical generalization established above. UE-indefinite subjects, but not DE-indefinite ones are allowed to reconstruct below a universal operator. (29) repeats the paradigm. The GSEC explains this by ruling out the inverse scope structure in (29b), as it would lead to a strictly stronger reading than the surface structure.

(29) a. More than three students are certain to pass, (i.e., it's certain that at least four pass) (more than 3 > certain) (certain > more than 3)

b. Fewer than three students are certain to pass, (#i.e., it's certain that at most two pass) (fewer than 3 > certain) *(certain > fewer than 3)

The pattern observed in (29) makes a prediction for a theory using the GSEC. When the surface scope reading is pragmatically infelicitous in a construction similar to (29), the sentence should be fine with UE-indefinites, but not so with DE-indefinites. The reason for this is that with UE-indefinites there is also the option with the subject reconstructed below the universal operator. But with DE-indefinites this option is not available, as the reading would be stronger than the surface scope interpretation and thus blocked by the GSEC.

Consider the acceptable (30a) and the infelicitous (30b) under the context given in (30).

(30) *Context:* Speaking about a driving exam that takes place every day.

a. More than three people from New York City always pass
#(more than 3 > always) (always > more than 3)

b. #Fewer than three people from New York City always pass
#(fewer than 3 > always) *(always > fewer than 3)

First, consider (30a). The surface scope interpretation which can be paraphrased as in (31a) below, is pragmatically odd due to our general knowledge of driving exams. The inverse scope reading, on the other hand, has the paraphrase in (31b) below which fits our assumptions about driving exams. Since the inverse scope reading in (31b) is asymmetrically entailed by the surface scope reading in (31a), hence is weaker than it, the GSEC predicts that the relevant CSSO can apply in (30a). That is, the only appropriate reading for (30a) is the pragmatically coherent inverse scope one, and the sentence is predicted to be felicitous by the GSEC.

(31) a. 'There are more than three people from New York who take the exam repeatedly and always pass.'

b. 'It is always the case that more than three people from New York pass the exam.'

Why is (30b) infelicitous? Again, the surface scope reading for (30b), paraphrased in (32a) below, is pragmatically odd. But this time the inverse scope reading given in (32b) asymmetrically entails the surface scope reading, i.e., the latter is strictly stronger than the former. So the GSEC predicts reconstruction to be impossible in (30b). The only allowed interpretation results in pragmatic oddness and thereby the sentence becomes infelicitous.

(32) a. 'There are fewer than three people from New York who take the exam repeatedly and always pass.'

b. 'It is always the case that fewer than three people from New York pass the exam.'

The general oddness of examples like (30b) is a strong argument that CSSOs that lead to strengthened interpretations are not generated by the grammar. Let us see what a theory with Truth Dominance alone would say about cases like (30a) and (30b). The logic of Truth Dominance is that of a charity principle. This has the consequence that if the surface scope reading results in some kind of pragmatic anomaly, whereas the inverse scope reading does not, the most charitable understanding of the relevant sentence will correspond to the inverse scope reading. In other words, the otherwise non-detectable inverse scope reading should become detectable in

(30b). This means that the relevant sentence should be felicitous with both UE-indefinites and DE-indefinites, because inverse scope should be facilitated. This is not the case.

In sum we must conclude that the GSEC is part of grammar. Otherwise the data discussed in the present subsection could not be accounted for. To be sure, we are not claiming that Truth Dominance as a concept is dispensable with. Rather we think that the data investigated provide support for the assumption that the GSEC is needed in addition to it.

5.4 Two classes of systematic exceptions

In the present section we will look at two classes of apparent exceptions to the GSEC. We will see that we can find reasons for why they behave the way they do.

5.4.1 Quantifiers at the right edge

We said that (33) does not have an inverse scope reading, as this would correspond to a strengthening in meaning which the GSEC rules out.

(33) John didn't meet every guest $(\neg > \forall)$ $*(\forall > \neg)$

We notice, however that (34) does have a wide scope reading available.[14] At first sight this is completely unexpected. The quantifiers involved in (34) are the same as in (33). Nevertheless only the latter is subject to the GSEC apparently.

(34) The student couldn't answer every question that was marked with a star
$(\neg > \forall)$ $(\forall > \neg)$

We now suggest an explanation for this pattern. In particular, we suggest that it is only quantifiers that are positioned at the right edge that can undergo a particular movement operation that allows scope shifting nevertheless. What distinguishes (33) from (34) is that only in the latter

[14] We thank an anonymous reviewer for SuB 14 for reminding us of data like (34).

case the movement that leads to a new scope relation can be overt. In particular, the universal quantifier can undergo Heavy NP Shift (HNPS) in (34) – that is, string-vacuous movement to the right – to scope over negation, but not in (33), because in the latter case the QNP is not phonologically heavy enough. This means that (33) has (35) as its underlying structure under the inverse scope construal.[15,16]

(35) [the student [couldn't answer t_1]] [every question that was marked with a star]$_1$

Note now that the universal quantifier overtly scopes over negation. Under the reasonable assumption that the GSEC only evaluates covert movement, the movement process in (35) is not subject to evaluation by it. Therefore the inverse scope representation can be generated without recourse to the covert component of grammar. In (33), however, this is not the case, because the QNP is not phonologically heavy enough to undergo HNPS.

This makes certain predictions. In particular, inverse scope interpretations of examples minimally different from (34) where a CSSO is necessary to achieve wide scope for the QNP should not be allowed. For instance, the free wide scope of the universal in (34) should disappear, once we make sure that the universal quantifier cannot undergo string-vacuous HNPS. So if we place material that needs to be in the scope of negation to the right of the universal quantifier, the latter should not be able to move high enough to take scope over negation by overt movement. A CSSO would be called for, but this is ruled out by the GSEC.

This prediction is borne out. Consider the scopally ambiguous (36) and the unambiguous (37). Both examples use NPI *yet*, which must be in the scope of negation to be licensed. In (36) the universal precedes the NPI. In order for it to take scope over negation itself, it has to undergo movement. Covert movement is of course an option, but it is blocked by the scalar implicature.

[15]Note that Kayne (1998) proposes a system, where all QR is actually overt rightward movement (also cf. Fox and Nissenbaum (1999) for a related though distinct proposal). It is unclear to me whether this is fully compatible with the present approach. Also cf. Wagner (2006b) who argues for string-vacuous movement to the right for givenness calculation. The intuition behind our proposal is that in some cases the grammar can attribute a different syntactic parse to a string before LF. Cf. Huang (1982) for a proposal along these lines to account for certain parametric scope differences between English and Chinese.

[16]Note that I abstract away from possible focus-related movement of the universal quantifier in (33) that might make an inverse scope reading possible after all. It seems that this movement would also have to be to the right.

Overt movement to the right would not be high enough, because in order to take scope, the universal would have to move past the NPI. Therefore the lack of ambiguity is expected.

(36) I haven't solved every problem that was marked with a star yet

($\neg$ > *yet* > $\forall$) *($\forall$ > $\neg$ > *yet*)

(37) differs from (36) in having the universal follow the NPI. Therefore its possibilities w.r.t. HNPS are not restricted and it can take scope over negation. Therefore the scope ambiguity in (37) is again explained by appeal to overt movement.[17]

(37) I haven't solved yet every problem that was marked with a star

($\neg$ > *yet* > $\forall$) ($\forall$ > $\neg$ > *yet*)

Similarly, the account relying on overt movement to the right predicts that the ECM-marked universal quantifier in (38) cannot take scope over negation. It is not on the right edge. Therefore covert movement would have to apply. But, again, this movement is blocked.[18]

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[17]The following data from Kayne (1998) make a similar point as the ones just discussed, although no violation of GSEC is involved. Nevertheless quantifiers at the right edge can violate the clause-boundedness of QR (May 1985), whereas ones that are not on the right edge cannot do so. Note that rightward movement is usually taken to be clause-bound as well, although the restriction is of a different sort, which is traditionally captured by the so-called right roof constraint (Ross 1967). We do not know why this restriction does not apply in the cases considered here.

(i) a. I will force you to turn down no one. (force > $\neg\exists$) ($\neg\exists$ > force)
b. I will force you to turn no one down. (force > $\neg\exists$) *($\neg\exists$ > force)
(Kayne 1998:142)

(ii) a. She has requested that they read not a single linguistics book. (request > $\neg\exists$) ($\neg\exists$ > request)
b. She has requested that not a single student read our book. (request > $\neg\exists$) *($\neg\exists$ > request)
(Kayne 1998:128f.)

[18](38) shows that ECM-marked subjects can indeed take scope over the matrix subject (cf. (May 1985:44)). I.e. covert movement to the matrix level is not blocked in general. We thus expect the relevant CSSO to be subject to the theory advocated in the text.

(i) A different boy wants every girl to marry him ($\exists$ > $\forall$) ($\forall$ > $\exists$)

(38) *Context:* These students usually don't solve any problem whatsoever.
I don't expect every problem that was marked with a star to be solved (¬ > ∀) *(∀ > ¬)

The same observation applies to subjects embedded by perception verbs. (39) and (40) do not allow the inverse scope reading, because the universal quantifier cannot undergo rightward movement to a high enough position.

(39) I didn't see every building collapse (¬ > ∀) *(∀ > ¬)

(40) I didn't see every girl laugh (¬ > ∀) *(∀ > ¬)

The fact that the linear position of certain quantifiers matters for their scope taking abilities has thus been shown to actually lend support to the account proposed.

5.4.2 Modal auxiliaries

Let us now turn to a second class of operators that are apparently excluded from the GSEC, namely certain modals. When we consider (41) in the context given, we notice that inverse scope is possible, although the subject that has to undergo reconstruction below the universal modal is a DE-quantifier. That is, the sentence in (41) clearly has the inverse scope reading paraphrased in (42b) below. According to the GSEC and the arguments given in the preceding sections, this state of affairs should be prohibited. In fact, the surface scope interpretation is pragmatically not very salient. It is paraphrased in (42a) and it has the consequence that the dinner is likely to be pleasant anyway.[19]

(41) *Context:* A dinner party is to take place, but the host hopes that there will not be too many people attending, for otherwise it could be a disaster. The host thus thinks ...
Fewer than five people must come for the dinner to be pleasant
#(fewer than 5 > □) (□ > fewer than 5)

[19]Note that (41) has an additional interpretation, which we ignore here due to lack of space, and which can be paraphrased as 'the number *n* such that it must be the case that *n* people come and it is not necessary that more than *n* people come for the dinner to be pleasant is smaller than 5'.

(42) a. 'There are fewer than five people such that they must come for the dinner to be pleasant.'

b. 'It must be the case that fewer than five people come for the dinner to be pleasant.'

This is puzzling given our theoretical assumptions. In particular so, because w.r.t. this behavior (41) differs from the well-behaved (43) and (44), repeated from above. Especially (43) is puzzling when compared to (41). There are good arguments in the literature to treat modal auxiliaries as a type of raising verbs (cf. Brennan (1993), Wurmbrand (1999)). *to be certain* is a raising-predicate as well. But nevertheless it behaves as predicted by out theory as seen above. In other words, two universal modals that are assumed to be syntactically similar, behave differently when it comes to scope.

(43) Fewer than three students are certain to pass, (#i.e., it's certain that at most two pass) (fewer than 3 > certain) *(certain > fewer than 3)

(44) No doctor examined every patient $(\neg\exists > \forall)$ $*(\forall > \neg\exists)$

In the same vain, we observe that (45) allows for inverse scope, which is again ruled out by our theory.

(45) (Given the rules), you can talk to no one $(\Diamond > \neg\exists)$ $(\neg\exists > \Diamond)$

But when we replace the existential modal auxiliary with the raising predicate *be allowed to* (46) or the determiner *at least one*, the inverse scope is correctly ruled out again by the account.

(46) (Given the rules), you are allowed to talk to no one (*allowed* > $\neg\exists$) *($\neg\exists$ > *allowed*)

(47) At least one student of mine talked to no professor (at least 1 > $\neg\exists$) *($\neg\exists$ > at least 1)

The question there is: Why should modals behave differently from other quantifiers? There are two possible answers to this question that I can see at the moment. It is likely that a combination

of these answers or of similar answers is required to address the problem in its full generality. Let us now turn to the answers.

5.4.2.1 *De dicto* interpretations break the entailment relation

The fact that (41) apparently ignores the GSEC is only problematic if we do not take into account the semantic contribution of modal auxiliaries. If we take the standard view that modals quantify over possible worlds, the entailment relation between the surface and the inverse scope reading only holds, if the property *people* is interpreted relative to the world of evaluation in both the surface and the inverse scope reading. In other words, the inverse scope reading is only strictly stronger than the surface scope reading if *people* is interpreted *de re*. The surface scope interpretation is given in (48a). The *de re* interpretation of the inverse scope reading is given in (48b). The latter asymmetrically entails the former. If in all accessible worlds fewer than five people from the actual world come, then fewer than five people from the actual world are such that they come in all accessible worlds.

(48) a. $\exists x$[fewer than 5 people$(x)(w) \wedge \forall w'[wRw' \rightarrow$ come$(x)(w')]]$

b. $\forall w'[wRw' \rightarrow \exists x$[fewer than 5 people$(x)(w) \wedge$ come$(x)(w')]]$

But normally one also allows for a *de dicto* interpretation in such cases, which means that in the case of the inverse scope interpretation the property *people* can also be interpreted relative to the worlds quantified over by the modal in question. In this case the denotation of *people* in the worlds quantified over may vary from the one in the world of evaluation. In particular, if in each accessible world fewer than five people from that world come, then it does not follow that fewer than five people in the world of evaluation are such that they come in each accessible world. Moreover, the reverse entailment does not hold, either.

(49) a. $\exists x$[fewer than 5 people$(x)(w) \wedge \forall w'[wRw' \rightarrow$ come$(x)(w')]]$

b. $\forall w'[wRw' \rightarrow \exists x$[fewer than 5 people$(x)(w') \wedge$ come$(x)(w')]]$

This alone would be enough of an explanation for why the inverse scope reading in (41) is possible. Since there is no entailment relation between (49a) and (49b), the GSEC has no way to compare the strength of the readings. A solution along these lines is, however, problematic given the fact that we have seen that not all modals behave the same. For instance, the predicate *be certain* does follow the GSEC, as we have seen already. It seems therefore that either a completely different explanation is called for or at least an additional ingredient in the explanation is missing so far. In the following subsection we provide an additional observation that could prove important to determine why the GSEC sometimes applies and why it sometimes doesn't in the case of modals. It is shown that embedding predicates that are split along the lines of respecting and violating the GSEC differ along another dimension from each other.

But before discussing this observation it should be noted that, whether we want to adopt the answer relying on the *de re*/*de dicto* distinction depends on what we take to be the notion of entailment relevant to the GSEC. For we could also take the view that the GSEC, because it operates on very impoverished Logical Forms, fails to see that the entailment-relation is broken under a *de dicto* reading, in which case another answer is called for.[20]

5.4.2.2 Neg-raising predicates are exceptions

We suggest that the violation of the GSEC correlates with another well-defined property: A verbal predicate can violate the GSEC, if it is a neg-raising predicate. Consider the difference between deontic interpretations of the modals *must* and *have to*. Although both are necessity modals, they differ in their scope taking preferences w.r.t. linearly adjacent negation. In (50) the modal takes scope over negation, as the paraphrase shows, whereas in (51) it is the negation that has widest scope.

(50) a. John must not come for the party to be a success

b. 'In all accessible worlds, for the party to be a success, John doesn't come.'

[20]Following Fox's original proposal, and for entirely similar reasons (cf. (Fox 2000:70)), we assume that the GSEC operates in a 'modular way', to the effect that it does not 'see' all the details of the syntactic structure: the notion of entailment relevant to the GSEC would thus not be fully equivalent to the standard notion, as it is computed on the basis of impoverished representations.

(51) a. John does not have to come for the party to be a success

b. 'It is not the case that in all accessible worlds, for the party to be a success, John comes.'

We thus refer to modal auxiliaries as neg-raising, when they strongly tend to take scope over a linearly adjacent negation. When we now consider how *must* and *have to* behave w.r.t. the GSEC, we find an interesting difference. We have already seen that the former can violate the GSEC. The example is repeated in (52).

(52) Fewer than five people must come for the dinner to be pleasant

#(fewer than 5 > □) (□ > fewer than 5)

The modal *have to*, on the other hand, behaves as expected under our theory. For (52) we have already seen that the surface scope reading is not particularly salient, which is presumably due to the fact that it requires a strange situation: Fewer than five people are such that in all accessible worlds they come so that they dinner is pleasant. The inverse scope interpretation asymmetrically entails this reading: In all accessible worlds, there are fewer than five people who come so that the dinner is pleasant. This interpretation requires a perfectly normal situation. However, it is not available, as the GSEC predicts. Therefore (53) sounds strange, as only the unlikely surface scope interpretation is available.

(53) #Fewer than five people have to come for the dinner to be pleasant

#(fewer than 5 > □) *(□ > fewer than 5)

It must be noted that *have to* does not disallow reconstruction in general. As (54) shows, UE-indefinites allow the inverse scope reading, i.e., (54) does not sound odd. Again, this is predicted by the GSEC.

(54) More than five people have to come for the dinner to be pleasant

#(more than 5 > □) (□ > fewer than 5)

Hence (52) and (53) differ minimally in the sense that the former contains a neg-raising predicate, whereas the latter does not. We claim that this has an effect on their ability to disrespect the GSEC, although it is unclear why this is so.

Further confirmation for this generalization comes from the difference between the doxastic predicates *be believed to* and *be supposed to* on the one hand, and *be known to* and *be said to* on the other hand. Only the former are neg-raising predicates, but not the latter, as shown by the paraphrases for (55a), (56a), (57a), and (58a) in the respective (b)-examples.

(55) a. John is not believed to have been hit by the swine flu
b. 'John is believed to have not been hit by the swine flu.'

(56) a. John is not supposed to have been hit by the swine flu
b. 'John is supposed to have not been hit by the swine flu.'

(57) a. John is not known to have been hit by the swine flu
b. 'It is not known that John has been hit by the swine flu.'

(58) a. John is not said to have been hit by the swine flu
b. 'It is not said that John has been hit by the swine flu.'

Again, we notice that only the neg-raising doxastic predicates *be believed to* and *be supposed to* can violate the GSEC (59), but not the non-raising *be known to* and *be said to* (60). First the inverse scope reading in (59) is strictly stronger than the surface scope reading: If it is believed that there are fewer than 1000 Americans who have been hit by the swine flu, then it must also hold that there are fewer than 1000 Americans who are believed to have been hit by the swine flu. But the reverse entailment does not hold. The same applies to *be supposed to*. Since the inverse scope is possible in (59), the GSEC is violated. This correlates with the neg-raising property of the two predicates.

(59) a. Fewer than 1000 Americans are believed to have been hit by the swine flu
(fewer than 1000 > believe) (believe > fewer than 1000)

b. Fewer than 1000 Americans are supposed to have been hit by the swine flu
(fewer than 1000 > suppose) (suppose > fewer than 1000)

The inverse scope interpretation, on the other hand, is not available for the non-neg-raising doxastic predicates in (60). Again, we notice that it asymmetrically entails the surface scope interpretation: Imagine it is known that that fewer than 1000 Americans have been hit by the swine flu. In this situation there are fewer than 1000 Americans who are known to have been hit by the swine flu. But the reverse entailment does not hold. Parallel considerations apply to *be known to*.

(60) a. Fewer than 1000 Americans are known to have been hit by the swine flu
(fewer than 1000 > know) *(know > fewer than 1000)
b. Fewer than 1000 Americans are said to have been been hit by the swine flu
(fewer than 1000 > say) *(say > fewer than 1000)

Again, *be known to* and *be said to* do not block inverse scope in general – that is, reconstruction of UE-quantifiers is allowed under the same configuration, as (61) shows.

(61) a. More than 1000 Americans are known to have been hit by the swine flu
(fewer than 1000 > know) (know > fewer than 1000)
b. More than 1000 Americans are said to have been hit by the swine flu
(fewer than 1000 > say) (say > fewer than 1000)

This means that the non-neg-raising doxastic predicates conform to our theory, whereas the neg-raising ones again do not. It should also be noted that *be certain* which we have seen to follow the GSEC is not a neg-raising predicate, as shown by (62). Thus its behavior is parallel to the non-neg-raising predicates discussed in this subsection.

(62) a. John is not certain to have been hit by the swine flu
b. 'It is not certain that John has been hit by the swine flu.'

We therefore conclude that modal auxiliaries that do show neg-raising are free to violate the GSEC. Unfortunately I do not know why this should be so. But I am confident that this puzzle can be fruitfully addressed by future research that focuses on the property of neg-raising in more detail.

We will now consider a further prediction of this.

5.4.2.3 Epistemic Containment Principle and GSEC

Fintel and Iatridou (2003) provide ample evidence that epistemic modals always take maximal scope. For a subset of the epistemic modals this generalization will of course contradict the GSEC. For instance, for (63) they report that it can only have the wide scope interpretation of the modal, i.e., only the inverse scope interpretation is available. That is, (63) does not only require a situation where less than the half of the students are such that they must have passed. Rather, it is required that in each accessible world fewer than half of the students passed.

(63) Fewer than half of the students must have passed the test. (Otherwise there wouldn't be this uproar.)
(Fintel and Iatridou 2003:177)

That the surface scope reading 'Fewer than half of the students are such that in all accessible worlds conforming to our believes they have passed the test' is absent is shown by a continuation to (63) that triggers the surface scope reading:

(64) #Fewer than half of the students must have passed the test, but perhaps all of them did.
(Fintel and Iatridou 2003:177)

So (63) violates the GSEC obligatorily. Again, we do not address the issue why the situation is as it is. The reader is referred to Fintel and Iatridou (2003). What matters for us, though, is that epistemic *must* is of course a neg-raising predicate.[21] This makes the prediction that when the

[21] We have already seen that the deontic version of *must* is neg-raising. For possibly independent reasons the epistemic interpretation of *must* is not very salient (if possible at all), when followed by negation (65).

neg-raising property is factored out, epistemic modals should behave according to the GSEC. For instance, it is predicted that for non-neg-raising epistemic necessity modals the structure in (65) is ungrammatical.

(65) *[. . . DE-indefinite . . . [. . . epistemic necessity modal . . .]]

Consider in this light the sentences in (66) under the context given. Here *must* is replaced by *have to*, which we know does not have the neg-raising property. The context makes the surface scope interpretation disfavored. We only know the train schedule. So we cannot know that more than five people (or fewer than five people for that matter) are such that in all accessible worlds they are home by now. But the inverse scope reading is coherent with the context. In particular it allows that we know that in all accessible worlds more than five people are home by now or fewer than five people are home by now. But the latter interpretation is not available – that is, DE-indefinites cannot scope below the epistemic necessity modal *have to*. Thus the sentence sounds odd, in the given context.

(66) *Context:* Various people took trains to get home, and we know the train schedule, but we do not know who took which train.

a. Given what we know, more than five people have to be home by now
#(more than 5 > □) (□ > more than 5)

b. #Given what we know, fewer than five people have to be home by now
#(fewer than 5 > □) #(□ > fewer than 5)

(i) ?Given what we know, John must not be home by now

Note that (64) is in competition with (65). Epistemic *can* is not neg-raising. Thereby the meanings of (i) and (ii) become equivalent. If all worlds are such that not *P*, *P* a predicate, then there is no world such that *P*, and vice versa. Maybe this competition is the source of the oddness of (64).

(ii) Given what we know, John cannot be home by now

We conclude that the epistemic containment principle only leads to a violation of the GSEC, if the modal used has the neg-raising property. If it does not have it, the predictions of the GSEC are borne out. I.e., epistemic modals behave exactly the same as the modal auxiliaries considered in the preceding subsection.

In sum we have seen two classes of systematic exceptions to the GSEC: Quantifiers on the right edge and neg-raising modal auxiliaries. For the former an explanation for their behavior was provided. For the latter, on the other hand, I did not do so. Rather I relied on the fact that the class is well-defined. This makes the exception to the theory systematic and therefore not as threatening as one might think at first sight. However, it was also speculated that *de dicto* interpretations might also play a role in the fact that the GSEC can be violated by certain modals.

5.5 Further considerations and discussion

In the present section we discuss some further considerations and consequences of the theory proposed in this chapter. First, I address the question of scope ambiguities in DE-contexts. Lastly, I briefly comment on wide-scope indefinites.

5.5.1 DE-contexts

Imagine a sentence where inverse scope is uncontroversially available, such as (67). Here the inverse scope interpretation, according to the GSEC, is detectable, because it is strictly weaker than the surface scope interpretation.

(67) A boy dances with every girl

But when (67) is embedded in a DE-context, the inverse scope reading would become strictly stronger than the surface one. The reason for this is, of course, that DE-expressions reverse the entailment patterns. For a sentence like (68) where we have placed (67) in the antecedent of a conditional, this means that the overall strength of the inverse scope reading is now stronger

than the one of the surface scope reading.

(68) If a boy dances with every girl, the party will be a success $(\exists > \forall)(\forall > \exists)$

To see this consider the surface scope reading and the inverse scope reading, respectively:

(69) a. *Surface scope:* 'If there is a boy who dances with every girl, ...'

b. *Inverse scope:* 'If for every girl there is a boy who dances with her, ...'

Clearly, if (69b) holds, (69a) must hold as well: If it is true that, if for every girl there is a boy who dances with her, the party will be a success, then the party must also be a success if there is a boy who dances with every girl. The reverse, however, does not hold: If there is a boy who dances with every girl thereby making the party a success, it does not follow that the party will be a success, if for every girl there is a boy who dances with her.

What we observe is that the interpretation in (69b) is straightforwardly detectable in sentence (68). According to the logic of the present paper, the inverse scope LF should therefore be possible for (68), as well. But the GSEC as presently formulated does not allow us to do this. It predicts that the reading in (69b) should be absent. The same argument can be made on the basis of (70) and (71). We have seen that (70) has a readily detectable inverse scope reading.

(70) Every guest didn't show up $(\forall > \neg)\ (\neg > \forall)$

In (71) we have placed (70) under the DE-element *doubt*, i.e., the strength of the readings is reversed. The context makes both the surface scope reading and the inverse scope reading felicitous, as can be seen by looking at the paraphrases for the relevant readings in (72). Again, the crucial point is that the interpretation in (72b) is straightforwardly detectable and therefore the corresponding LF should be generated by the grammar, as well. But the GSEC does not predict this.

(71) *Context:* John knows that the party was a success, in fact he is pretty sure that everyone showed up, but is perfectly sure that at least most showed up.
John doubts that every guest didn't show up

(72) a. *Surface scope:* 'John believes there is a guest who showed up.'
b. *Inverse scope:* 'John believes that every guest showed up.'

The question is how the observations just made go together with the GSEC. One might think that the GSEC actually rules out the generation of the necessary inverse scope structures, since they lead to an interpretation that is strictly stronger than the ones of the surface structures. It must be noted, however that the GSEC leaves it open, whether the strength of readings is measured locally or globally. That is, the GSEC does not require to compute the mutual strength of readings at the global level of a sentence. Rather it allows local computation of strength, as well. The only requirement is that the mutual scopal relationship between two scope bearing elements is measured. In the present cases, when the inverse scope reading is generated, it must be the case that the GSEC applies at the embedded level. In (68), for instance, the DE-material that embeds *a boy dances with every girl* is not taken into account. Similarly in (71): Here the embedding verb is not taken into account, but only the embedded clause. We should therefore state the GSEC along the following lines:

(73) *Generalized Scope Economy Condition* (revised)
A CSSO in a sentence S can apply if and only if there is a subconstituent S' of S (possibly S itself) such that $[\![S']\!]$ in which the CSSO applies is neither stronger than, nor equivalent to $[\![S']\!]$ in which the CSSO does not apply.

Let us now turn to a related observation, namely the opposite of the situation just discussed.

5.5.2 Additional scope possibilities in DE-contexts?

Since DE-environments reverse the logical strength of readings, this, together with the revised formulation of the GSEC, makes it plausible that new scope possibilities arise when a sentence

is embedded in a DE-context. In other words, if a sentence whose inverse scope interpretation is blocked by the GSEC is embedded under DE-material, one might expect that the inverse scope interpretation all of a sudden becomes available, because it is now asymmetrically entailed by the surface scope reading.

Consider (74) in this light, again. As was shown in subsection 5.2.1 the CSSO necessary to generate the inverse scope interpretation is blocked, because the resulting reading would be strictly stronger than the surface scope interpretation. The reading that is ruled out is the following: 'No guest showed up.'

(74) A guest didn't show up $(\exists > \neg)$ $??(\neg > \exists)$

When (74) is embedded in a DE-environment as in (75)– that is, in the antecedent of a conditional – the inverse scope interpretation becomes available (cf. Spector (2004)). In particular, (75) can have as a possible interpretation the reading 'If no guest had shown up, the party would have been a disaster.' In order to obtain this interpretation, a CSSO is necessary. This CSSO, however, was not available in (74).

(75) If a guest had not shown up, the party would have been a disaster $(\exists > \neg)$ $(\neg > \exists)$

The GSEC as stated in the preceding subsection allows for such situations, in fact predicts their existence. The relative strength of interpretations can be calculated either locally or globally. If the global option is chosen in (75), it follows that the CSSO necessary to derive the inverse scope reading is licensed. Furthermore the modified GSEC ensures that the surface scope reading is not lost in these cases, because the GSEC can still be met locally. Moreover, the local option also allows for the generation of the inverse scope interpretation in the constructions discussed in subsection 5.5.1. Remember that in these cases the inverse scope reading was allowed, although the overall meaning of the sentence with inverse scope was strictly stronger than the one with surface scope. We attributed this to local checking of the GSEC, as well.

Let us consider further examples where embedding under DE-material creates additional

scope possibilities. Consider (76). We have seen that under the context given the surface scope reading is odd, because it would say that there are (fewer than three) people who take driving exams repeatedly. The inverse scope reading, on the other hand, is a coherent interpretation, saying that it is always the case that fewer than three people pass. The inverse scope reading is strictly stronger than the surface scope reading and therefore ruled out by the GSEC.

(76) *Context:* Speaking about a driving exam that takes place every day.
#Fewer than three people from New York City always pass.
(fewer than 3 > always) *(always > fewer than 3)

But if the sentence in (76) is embedded under DE-material, the inverse scope reading appears. In (77) it is embedded in the antecedent of a conditional. The sentence in (77) clearly has the inverse scope reading 'If it is always the case that fewer than three people from New York pass, the exam must be quite hard.' If it didn't have this reading, the sentence should be as odd in the context given as (76).

(77) *Context:* Speaking about a driving exam that takes place every day.
If fewer than three people from NY always pass, the exam must be quite hard.
#(fewer than 3 > always) (always > fewer than 3)

In (78) (76) is embedded in the restrictor of a universal quantifier, another DE-environment. The context makes the surface scope reading completely infelicitous – that is, (79a) is not an interpretation of (78). Given that (78) is not odd in the context given, the inverse scope interpretation should be available, as predicted.

(78) *Context*: During the last 5 months it was always the case that 2 people from NY passed the exam. Out of these each one passed it at the first trial.
So everyone who had claimed that fewer than 3 people from NY always pass, was right.

(79) a. 'So everyone who had claimed that there are fewer than 3 people from NY who always pass, was right.'

b. 'So everyone who had claimed that it is always the case that fewer than 3 people from NY pass, was right.'

5.5.3 Wide-scope indefinites

It is often claimed that indefinites can take exceptional wide scope. This is not the place to get involved in this debate (cf. Heim (1982), Abusch (1994), Reinhart (1997), Winter (1997), Chierchia (2001) a.m.o.). But it does seem to us that the indefinite in (80) can take wide-scope marginally. The intuitions are notoriously difficult for cases such as (80), probably due to a principle such as Truth Dominance (Abusch (1994), Reinhart (1997)). Nevertheless, this would contradict the GSEC.

(80) Every student heard some/a teacher talking on the phone

We want to point out that exceptional wide scope for indefinites is not a problem for the GSEC, though. Indefinites are widely believed to be able to get a wide scope interpretation without QR. The actual process that achieves this is immaterial to the discussion at hand. Assume for concreteness, however, that some form of existential closure can apply at different levels.[22] What is important for us is that indefinites be interpreted *in situ* and yet get a wide scope reading. The GSEC only applies to QR and reconstruction – that is, to CSSOs associated with movement – and so a wide scope interpretation for indefinites is never ruled out by the GSEC. In this we actually follow Fox's 2000 view.

[22]For different approaches see Heim (1982), Reinhart (1997), Winter (1997), Kratzer (1998b), Matthewson (1999), or Chierchia (2001). Also cf. the critical remarks by Geurts (2000). Note, however that they only apply to a proper subset of the approaches cited, in particular the ones using choice functions.

5.6 Scalar reasoning and quantifier scope

The preceding sections established that the mutual strength of surface and inverse scope interpretations plays a role in whether the inverse scope representation is licensed. The meaning of the inverse scope must not be stronger than the one of the surface scope. This is captured by the GSEC. We will now show that the GSEC can be reduced to another phenomenon relying crucial on notion of strength, namely scalar reasoning. First I introduce some background on conversational reasoning and its relation to scalar implicatures. Then I will introduce the central idea.

5.6.1 Gricean reasoning and the symmetry problem

Consider the following sentence:

(81) John read some books by Tolstoy

(81) when uttered in a normal communication conveys more information than just its plain assertive component:

(82) a. John read some books by Tolstoy or all of them
b. John didn't read all books by Tolstoy

The inference (82a) stems from the "literal" meaning of (81): Reading some books by Tolstoy does not exclude reading all of the books by Tolstoy. This is so, because the latter entails the former: Having read all of the books by Tolstoy entails having read some of them. And, indeed, uttering (81) suggests that it is as at least compatible with the situation that John read all books by Tolstoy. (82a) is referred to as the basic inference of (81). But (81) also strongly suggests that John did not read all books by Tolstoy, i.e., when we hear the sentence we derive the inference in (82b). In other words, the inference in (82b) settles what the basic inference in (82a) left open. (82b) is the so-called scalar implicature associated with (81). We know that it is an implicature, because it is cancelable, as (83) shows. Here the inference in (82b) is blocked

by the continuation added.

(83) John read some books by Tolstoy, in fact he read all of them

The question is how the inference in (82b) is to be derived. Following Grice (1975) one might assume that the inference is derived through general principles of communication. Grice argued that there is certain communicative principles, the Maxim of Quantity being one of them. The overarching principle is the Cooperative Principle, which requires speakers to follow the sub-principles and can be rendered as follows: *Be cooperative!* The Maxim of Quantity requires that if there are two propositions such that both of them are relevant to the conversation at hand, the one with more information is to be preferred. A proposition p is more informative than proposition q if it is logically stronger than q – that is if p asymmetrically entails q.[23] The Maxim of Quantity could then be defined as in (84).[24]

(84) *Maxim of Quantity*

Assume p and q are both relevant to the conversation and p is more informative than q. If the speaker believes that both p and q are true, the speaker should prefer p to q.

One way to go in order to explain the scalar implicature in (82b) would then be to make use of the Maxim of Quantity. Assume that p is as in (85a) and q is as in (85b). Both are relevant to the conversation according to relevance. We furthermore notice that q is more informative than p, because if John read all books by Tolstoy, he must have read some books by Tolstoy, too. According to the Maxim of Quantity, this constitutes a situation, where q is to be uttered

[23]Relevance is left at an intuitive level: What is meant is that for a conversation the truth of certain propositions is relevant. The content of the proposition must be somehow related to the topic of conversation. But cf. the following subsection for a precisification of relevance.

[24]Grice's original formulation of the Maxim of Quantity is given in (i), quoted from (Grice 1989:26)

(i) *Quantity*

a. Make your contribution to the conversation as informative as is required (for the current purposes of the exchange).
b. Do not make your contribution more informative than is required.

rather than p, if the speaker believes both q and p to be true. Given that the speaker nevertheless uttered p, it can be concluded that the speaker does not believe that q. This means that we have an enriched meaning for (81) saying that the speaker believes that p and the speaker does not believe that q.

(85) a. p = John read some books by Tolstoy

b. q = John read all books by Tolstoy

There is a problem with this reasoning, however. As discussed by Fox (2007) attributing the statement of the problem to class notes by von Fintel and Irene Heim (cf. Horn (1972), Kroch (1972) a.o.), the explanation given above leads to the inclusion of possibly relevant propositions that are not wanted in the reference set. There is another proposition q' whose truth would be relevant to the conversation and which is also stronger than p, namely (86). The problem is completely general, because if one arrives at the conclusion that the speaker believes that p and does not believe that q, as was just argued, it is reasonable to assume that the speaker has an opinion about p $\wedge\neg$ q. I.e., for any proposition p generating a scalar implicature q there is a relevant proposition q', where q' = p $\wedge\neg$ q.

(86) q' = John read some books by Tolstoy, and it is not the case that John read all books by Tolstoy

q' in (86) is more informative than p in (85a) and it is presumably relevant to the conversation. By the same reasoning as above, we arrive at the following: The speaker uttered p. Since q' is more informative than p, the speaker does not believe that q' is true. This gives the strengthened meaning in (87)

(87) The speaker believes that p, he does not believe that q and he does not believe that q' = B_s(John read some books by Tolstoy) $\wedge\neg B_s$(John read some books by Tolstoy and not all books by Tolstoy)

(87) states that John did read all books by Tolstoy contradicting the implicature derived on the basis of q. Therefore the inclusion of both q and q' would lead to something weaker than a scalar implicature. All that is derived is an ignorance inference saying that the speaker neither believes that q and q' are true nor that she believes that q and q' are false. This problem is referred to as the symmetry problem.

5.6.2 Scalar implicatures and Horn-sets

The by now familiar way to address the symmetry problem is to redefine the set of alternatives that are relevant for the derivation of scalar implicatures. Following Horn (1972) and Gazdar (1979) the so-called *Neo-Gricean* view of scalar implicatures assumes that scalar items like *some*, *may*, *no*, *or* etc. have a well-defined class of competitors or alternatives. These alternatives are usually referred to as Horn-sets/scales. These Horn-sets contain elements of the same semantic type that could serve as alternatives for the scalar item used. It is generally assumed that UE-quantifiers form a separate Horn-set from DE-ones (88)– that is, the scalar items are grouped together according to their monotonic properties (cf. Fauconnier (1975), Horn (1989), Matsumoto (1995), but see Katzir (to appear) for a different view).[25]

(88) a. {some, many, all}

b. {no, few}

c. {may, must}

d. {or, and}

We can now define alternative meanings for a given proposition p based on the elements in the Horn-set following Sauerland (2004) and Fox (2007). An alternative is defined as the set of all propositions derived from p by replacing the scalar item with the members in the Horn-set:[26]

[25]The assumption that *or* and *and* form a set of alternatives, as well, allows one to derive exclusive disjunction from the inclusive meaning of *or*. In other words exclusive disjunction corresponds to $p \vee q \wedge \neg(p \wedge q)$.

[26]For a different way of deriving the set of Horn-alternatives see Katzir (to appear) and Fox and Katzir (2009), where the alternatives are defined in a structural way. Especially the latter draws the apparent parallel to Rooth's 1985 definition of focus values clearly.

(89) *Horn-alternatives*

For a given proposition p with a scalar item α, the Horn-alternatives, Alt(p), are the set of propositions obtained by replacing α with α' where α' is a member of the Horn-set of α, Alt(α): Alt(p) = $\{\phi : \phi = p_{[\alpha'/\alpha \wedge \alpha' \in Alt(\alpha)]}\}$

We must furthermore adjust the Maxim of Quantity to take account of the scalar implicature for (81). In other words, for a proposition p the only relevant propositions q are the ones in the set of Horn-alternatives of p. The scalar implicatures are computed solely on the basis of the set of Horn-alternatives. This has the immediate effect that q' in (86) will not be an alternative to p. The Neo-Gricean (cf. Horn (1972, 1989), Gazdar (1979), Sauerland (2004) a.o.) way of deriving the relevant scalar implicature for (81) is by redefining the Maxim of Quantity along the following lines:

(90) *Neo-Gricean Maxim of Quantity*

Assume q ∈ Alt(p) and q is more informative than p. If the speaker believes that both p and q are true, the speaker should prefer q to p.

Coming back to our original example (81) the reasoning how one arrives at the correct scalar implicature is now clear. The speaker said p, repeated below. q ∈ Alt(p). Moreover, q would have been more informative than p. Therefore if the speaker believed that q is true, she should have used q according to (90). Thereby we can conclude that the speaker does not believe that q is true, i.e., the speaker believes that p and she does not believe that q.

(91) a. p = John read some books by Tolstoy

b. q = John read all books by Tolstoy

q' that caused the symmetry problem is not problematic anymore. This is so, because (92) ∉ Alt(p). By the revised Maxim of Quantity it will never be considered when computing the scalar implicature, because the Horn-alternatives are the only relevant ones. I.e, no contradiction arises.

(92) q' = John read some books by Tolstoy, and it is not the case that John read all books by Tolstoy

There is one more problem to be considered at this point. Note that the strengthened reading that the Neo-Gricean approach derives is not as strong as one might wish. In particular we get the meaning *the speaker believes that John read some books by Tolstoy, but she does not believe that John read all books by Tolstoy*. As pointed out by Soames (1982), Groenendijk and Stokhof (1984), Sauerland (2004), Chierchia et al. (2008) what we would like to obtain is *the speaker believes that John read some books by Tolstoy, and she believes that John did not read all books by Tolstoy*. Thus there needs to be a "neg-lowering" property involved in order to get to the correct result (Gazdar 1979). Sauerland (2004) calls this property the *epistemic step*. In the discussion below it is assumed that it necessarily applies. We will where no confusion arises abbreviate the strengthened meanings as $p \wedge \neg q$ instead of writing $B_S(p) \wedge B_S(\neg q)$ where the epistemic step has been performed.[27]

5.6.3 Generalized Scope Economy and scalar implicatures

Recall from above that (93) does not allow the inverse scope reading, i.e., (93) cannot mean that John didn't meet any student of mine.

(93) John didn't meet every student of mine $(\neg > \forall)$ $*(\forall > \neg)$

Moreover, recall that the GSEC correctly captured the scope possibilities observed in (93). The inverse scope reading asymmetrically entails the surface scope interpretation. To see this, assume that it is not the case that John met every student of mine. This does not entail that every student of mine is such that John didn't meet him. On the other hand, if every student of mine is such that John didn't meet him is true, it must also be true that it is not the case that John met every student of mine. Thus the inverse scope reading is strictly stronger than the surface scope

[27] In section 5.8, it is argued that the data at hand suggest a treatment of scalar implicatures in the semantic/syntactic component of grammar. In particular, the insertion of an exhaustivity operator allows one to have negation in the scope of the believe-operator (cf. Chierchia et al. (2008).)

reading. By the the GSEC the CSSO necessary to generate it, should not be allowed. I.e., the GSEC is a correct descriptive statement wrt. to our intuitions regarding (93).

What could an explanatory theory regarding (93) look like, on the other hand? I want to argue that the correct theory of scalar implicatures provides such an explanation, if a few additional assumptions are made. In particular, let us assume that the surface scope interpretation is the most salient interpretation, i.e., always available. This is similar to the assumptions that motivated Truth Dominance (Meyer and Sauerland 2009). As with other sentences containing scalar items that have no chance at being ambiguous, conversational reasoning starts therefore with the surface scope interpretation of the sentence. In (93) the scalar item is *every*. Assume that the relevant Horn-set is {a/some, every}. Thus the two alternatives that are needed for computation are as in (94).

(94) a. p = John didn't meet every student of mine

b. q = John didn't meet a student of mine

According to (90) all the alternatives that are stronger than the one uttered are negated. Although *every* entails *some* according to our generalized definition of entailment (cf. fn. 5 above), it is still the case that q asymmetrically entails p. This is so, because the scalar item *every* is in a DE-environment, and therefore the entailment patterns are reversed. Thus a hearer of the sentence (93) reasons q would be relevant – because it is a member Alt(p) –, and it is more informative than p. By Quantity the speaker should have uttered q, if she believed that q is true. The strengthened meaning of the surface scope in (95) is derived, with the necessary qualifications regarding the epistemic step.[28] It also seems that (95) is indeed the meaning associated with (93) in a normal conversational environment.

(95) John didn't meet every student of mine, and John met some student of mine

[28]That is, the actual implicature – that is, *the speaker does not believe that John didn't meet a student of mine* – is by neg-lowering equivalent to the proposition that the speaker believes that John met a student of mine. Note that *know* might be a better rendition in the present case than *believe*. The former, however, has undesired factivity presuppositions, whereas the latter has the neg-raising property. Fox (2007) discusses this problem.

Notice now that the strengthened meaning in (95) would contradict the inverse scope reading for (93). The non-available inverse scope interpretation would say that every student is such that John didn't meet him. This clashes with the strengthened interpretation of the surface scope interpretation.

It is important that it is not the meaning before the epistemic step that is factored in. Again, this would only say that the speaker does not believe that p – that is, that John didn't meet a student of mine. I.e., the speaker neither believes that p is true nor that it is false. Fox (2007) terms this an ignorance inference. This ignorance inference itself is compatible with the inverse scope reading which says that every student of mine is such that John didn't meet him. But as explained above, if the epistemic step applies, we get the stronger strengthened meaning in (95). And this one contradicts the hypothetical inverse scope interpretation. I.e., we have just observed an instantiation of blocking a CSSO by a scalar implicature.

Note again that for this to work it must be ensured that conversational reasoning works on the basis of the surface scope of a given sentence. Inverse scope representations are then only generated by the grammar if they do not stand in conflict with the strengthened meaning of the surface scope, i.e., after all scalar implicatures have been factored into the meaning of the surface scope interpretation. Of course, we have not shown yet that this idea generalizes to the other cases discussed in the preceding sections. In particular, we must show that the factoring in of implicatures into the surface scope interpretation as just outlined does not create problems for sentences with existing scope ambiguities. In the following section, we will investigate how far the assumptions just made take us when trying to base the GSEC on an independently motivated mechanism.

5.7 Scalar implicatures blocking scope shifting

In the present section we look at the data from section 5.2 or similar ones for which we have seen that the GSEC rules out the inverse scope interpretation. I argue below that the absent interpretations are all in conflict with the scalar implicatures generated by the surface scope in-

terpretation. For the present purposes I will ignore the reasoning about the speaker's intentions as introduced in the previous section. Rather I will directly state the Horn-alternatives associated with the surface scope reading and show that the strengthened surface scope interpretation blocks the inverse scope reading. The reader should bear in mind that this is always compatible with the more detailed approach outlined in the preceding section, as long as the epistemic step is assumed.

5.7.1 Some facts

Consider the two sentences in (96) and (97) again. Only the former has an inverse scope reading.

(96) Every student of mine didn't show up $(\forall > \neg)\ (\neg > \forall)$

(97) John didn't meet every student of mine $(\neg > \forall)\ *(\forall > \neg)$

We have already seen that the surface scope interpretation of (97) gives rise to the scalar implicature in (98) and therefore the strengthened interpretation in (99) where strengthening amounts to factoring in the negation of the stronger alternative into the basic meaning. The strengthened meaning was shown to contradict the potential inverse scope interpretation of (97). I argued that the strengthened meaning thereby blocks the inverse scope interpretation.

(98) It is not the case that John didn't meet some/a student of mine

(99) John didn't meet every student of mine and he met some student of mine

The surface scope reading associated with (96), on the other hand, does not have a scalar implicature. In particular, it does not have (100) as a scalar implicature.

(100) It is not the case that some/a student of mine didn't show up

Why is this? Remember that we claimed that scalar implicatures are derived by negating all the stronger alternatives to the sentence uttered where the alternatives are generated by replacing

the scalar items with its scalar alternatives. These alternatives were referred to as Horn-sets. We said that the alternatives for *every* are {some/a, every}. We furthermore notice that *every* is stronger than *some/a*, meaning the former asymmetrically entails the latter. The alternatives for the surface scope of (96) would be as in (101). Note that (101a) is stronger than (101b). This is so, because *every* in (96) is not in a DE-environment and thus the entailment patterns are not reversed as in the case of (97) which was discussed in the preceding section.

(101) a. p = Every student of mine didn't show up

b. q = Some/a student of mine didn't show up

Given that the only relevant alternative to p is not more informative than p, no scalar implicature for the surface scope of (96) can be derived. Thus the strengthened meaning of the surface scope corresponds to the surface scope interpretation without any implicatures factored in.[29] Because of this there is no reason why the inverse scope interpretation should be blocked either. The plain surface scope interpretation is compatible with the inverse scope meaning. In fact, the former asymmetrically entails the latter, as we have seen. I.e., the scopal ambiguity observed for (96) is predicted by the theory of scalar implicatures.

Consider now the difference between the sentences (96), repeated as (102), and (103). The former as we have just seen allows for an inverse scope reading given the theory advanced here. For the latter, on the other hand, the inverse scope reading is very difficult to get.

(102) Every student of mine didn't show up $(\forall > \neg)\ (\neg > \forall)$

(103) A student of mine didn't show up $(\exists > \neg)\ ??(\neg > \exists)$

[29] Of course, if the negation of q would be factored into the meaning of the surface scope for (96) the contradictory statement in (i) would be derived. The negation of q saying that no student of mine didn't show up is equivalent to the proposition stating that every student of mine showed up.

(i) #Every student of mine didn't show up and every student of mine showed up

Let us consider then the Horn-alternatives for the surface scope of (103). They are as in (104) where q is stronger than p, because the relevant scalar items are again not in a DE-environment.

(104) a. p = A student of mine didn't show up

b. q = Every student of mine didn't show up

To generate the strengthened reading of the surface scope, the stronger alternative – that is, q – is negated. The scalar implicature of the surface scope is as in (105). The strengthened meaning of the surface scope is (106). Now, the unavailable inverse scope interpretation for (103) would say that no student of mine showed up. It is easy to see that this interpretation would be in conflict with the strengthened interpretation of the surface scope, as (106) states that at least one student showed up.

(105) Not every student of mine didn't show up

(106) A student of mine didn't show up and a (different) student of mine showed up

Again, the present theory correctly draws the line between the scopal possibilities of (102) and (103).

5.7.2 UE-indefinites vs. DE-indefinites

We have also seen that there is a systematic difference in the scopal possibilities of UE-indefinites and DE-indefinites. Consider the minimal pair in (107) and (108). (107) contains an UE-indefinite in subject position, which allows for an inverse scope interpretation, whereas (108) has a DE-indefinite in the same position. Here the inverse scope interpretation is absent. This means, reconstruction of the subject is possible in (107), but not in (108).[30]

[30](Kayne 1998:139) notes the following minimal pair showing a parallel behavior. The account proposed by Kayne is not directly relevant for the present discussion. But his findings are accounted for by the present approach as well. I use different examples in the text, because it makes the exposition easier in terms of the relevant alternatives.

(i) a. Somebody is bound to be there $(\exists > \Box)\ (\Box > \exists)$

b. Nobody is bound to be there $(\neg\exists > \Box)\ *(\Box > \neg\exists)$

(107) Some of the girls are certain to win $(\exists > \Box)\ (\Box > \exists)$

(108) None of the girls is certain to win $(\neg\exists > \Box)\ *(\Box > \neg\exists)$

First, we recall that the GSEC predicts the differing behavior of (107) and (108). In (107) the surface scope interpretation asymmetrically entails the inverse scope interpretation. To see this, assume that there are some girls who are certain to win. In this case it is also certain that some girls win. On the other hand, if it is certain that some girls win, it need be true that there are some girls who are certain to win. A possible context would be one, where the vast majority of people taking part in the game are girls, but none of them is particularly likely to win. In (108), however, the absent inverse scope reading asymmetrically entails the surface scope reading. Assume that it is certain that none of the girls wins. If the surface scope reading were false in this situation – that is, if a girl were certain to win – a contradiction would arise. Thus the surface scope reading must be true as well. However, if there is no girl who is certain to win, it need not be certain that no girl wins. A suitable situation would be one where no girl is particularly likely to win, but there are only girls taking part in the game thereby making it certain that a girl will win.

Now consider how the present proposal accounts for these facts. First it must be noted that there are now two scalar items in each example. Both sentences have the raising verb *certain*. Let us assume that the Horn-alternatives for it are {possible, certain}.[31] As noted above the items in a given Horn-set share the same monotonicity (Fauconnier (1975), Horn (1989), Matsumoto (1995) a.o.). This means that *some* is in the Horn-set {some, all}, whereas *none* has {not all, none} as alternatives.[32] Given that we have two scalar items in each sentence above means that

[31]It seems that *it is possible that* should also be a relevant alternative, not least because it represents the scalar implicature of (108) best. Cf. the strengthened meaning in (110) below. However, the predicate *it is possible that* is not raising predicate and thereby excluded by a naive syntactic analysis of alternatives. I will nevertheless assume that it is an alternative. Since alternatives are defined as semantic objects, it seems that this assumption is harmless. If it should turn out that it is not, there is still the option to use *likely* as the relevant alternative for *certain*. The relevant Horn-set is presumably {possible, likely, certain} anyway.

[32]This is strictly speaking not correct. Both alternatives should include at least another scalar item: {some, many, all}, {not all, few, none}. For simplicity I assume the alternatives in the text. We come back to this question below.

more alternative propositions are now generated that need to be considered.

The alternatives for the surface scope interpretation of (108) are as in (109), but not all are actually used for the computation of scalar implicatures. Since *certain* is embedded in a DE-context, replacing it with its weaker alternative q' in (109c) will be relevant as the overall alternative is stronger than p. q in (109b), however, is weaker than p and thus not negated to form an implicature of the surface scope reading of (108). q" is logically independent from p: If there is a girl for who it is impossible to win, it need not be the case that none of the girls is certain to win. On the other hand, if none of the girls is certain to win as p says, it does not follow that there is a girl for who it is impossible to win. Thus the negation of q" is also not an implicature of the surface scope interpretation of (108).

(109) a. p = None of the girls is certain to win

b. q = Not all of the girls are certain to win

c. q' = For none of the girls is it possible to win

d. q" = For not all of the girls is it possible to win

The strengthened interpretation of the surface scope interpretation is then p $\wedge\neg$q':

(110) None of the girls is certain to win and there is a girl for who it is possible to win

The inverse scope interpretation of (108) says that it is certain that none of the girls wins which is equivalent to the proposition that there is no girl for who it is possible to win. This, however, contradicts the strengthened meaning of the surface scope in (110) which requires that there is a girl for who it is possible to win. The LF corresponding to the inverse scope meaning is therefore blocked by (110).

Our theory therefore also correctly predicts that inverse scope should be impossible in (111). The computation is more or less parallel to the preceding one. I leave it to the reader to verify this.

(111) No doctor examined every patient $(\neg\exists > \forall)$ $*(\forall > \neg\exists)$

Let us now turn to the scopally ambiguous (107). The alternatives of its surface scope meaning are listed in (112). Only q is stronger than p. q' is weaker than p and therefore not used for implicature derivation. q" is again logically independent from p and therefore also not generated as an implicature.

(112) a. p = Some of the girls are certain to win
b. q = All of the girls are certain to win
c. q' = For some of the girls it is possible to win
d. q"= For all of the girls it is possible to win

When the negation of q is factored into the surface scope interpretation, its resulting strengthened meaning is as in (113).

(113) Some of the girls are certain to win and not all of the girls are certain to win

The inverse scope interpretation of (107) says it is certain that some of the girls win. This is consistent with the strengthened meaning of (113). Thus the LF corresponding to the inverse scope can be generated by the grammar.

5.7.3 Multiple alternatives and context-insensitivity

Recall the following minimal pair. We notice that again the UE-indefinite in (114) can undergo reconstruction below the universal quantifier, whereas the DE-indefinite in (115) cannot. As argued above both conform to the predictions of the GSEC.

(114) Many windows are always open in this building (i.e., it is always the case that few are closed) (many > always) (always > many)

(115) Few windows are always open in this building (#i.e, it's always the case that most are closed) (few > always) *(always > few)

The difference between (114) and (115) is due to the fact that the subject in (114) is an UE-indefinite, whereas it is a DE-one in (115). I.e., the entailment patterns are reversed in the latter case. Let us now see whether the theory presented so far can account for this difference. First we have to determine what the alternatives for the determiners used in the examples are. Assume the following set of alternatives for *many*: {(some), many, all}. For *few* we have: {few, no}. For *always* the set of alternatives is {sometimes, often, always}. The scalar alternatives for the surface scope interpretation of (115) are then as in (116), where we ignore intermediate scalar items.

(116) a. p = Few windows are such that they are always open in this building
b. q = Few windows are such that they are sometimes open in this building
c. q' = No windows are such that they are always open in this building
d. q" = No windows are such that they are sometimes open in this building

q, q', and q" are each stronger than p with q" asymmetrically entailing all other alternatives. Assume that q" is true – that is, no windows are ever open in this building. Then it must be true that no windows are always open, i.e., q' must be true. Moreover if no windows are ever open, it must also be true that few windows are such that they are sometimes open, i.e., q must be true as well. Since q is stronger than p, q" must be stronger than p, too. Thus one might think that we only have to look at q" when computing the scalar implicature and the strengthened reading of the surface scope. The latter is as follows when the negation of q" is factored in:

(117) Few windows are such that they are always open in this building, but some windows are sometimes open

The missing inverse scope interpretation of (115) says that it is always the case that few windows are open in this building. The truth conditions for the inverse scope interpretation would be satisfied under the following context: Assume that the house has twenty windows and that we are talking about three worlds where in each world windows *a* and *b* are open (118).

(118) a. open windows in w_1: a, b

b. open windows in w_2: a, b

c. open windows in w_3: a, b

(118) would be a situation – among others – where the inverse scope interpretation is true, provided that the number of open windows, i.e., two, counts as few in the given context. However, this situation is also compatible with the strengthened reading in (117). The situation in (118) is such that there are few windows which are open in each world, but there are windows which are always open. By entailment they are also sometimes open and therefore the truth conditions of (117) are fulfilled by the situation given.

I want to suggest that what goes wrong is that we looked at the wrong Horn-alternative. Rather we also have to take q and q' into account when computing the scalar implicature. I propose the following condition. It forces one to pick the alternatives from a set of alternatives such that the strongest overall interpretation is derived – that is, the one strengthened meaning that entails all the other ones.[33]

(119) *Condition on strengthened meanings*

The strengthened meaning of p, $S(p)$ with $q_1, ..., q_n \in Alt(p)$, is equal to $p \wedge \neg q_i, ..., \wedge \neg q_j$ such that $\forall q \in Alt(p)(p \wedge \neg q_i, ..., \wedge \neg q_j) \subseteq p \wedge \neg q]$.

In particular, when both the negations of q and q' are factored into the meaning we derive a stronger meaning than before:

(120) Few windows are such that they are always open in this building, many windows are sometimes open, and some windows are always open

Assume the number of windows is four and there are only two accessible worlds. In this case *few*, it seems, must mean two or less, whereas *many* must mean three or more. Given (119), we

[33]This condition might be argued to follow from a more general tendency to use the strongest interpretation when facing a number of options (Dalrymple et al. 1998).

are now more or less confined to situations of the following sort. A plurality of windows must be open in each world according to the last conjunct of (120). Second, not more than two must be open in all worlds. Lastly, three windows must be such that they are open in at least one world. (121) satisfies this. But now the inverse scope reading is not true anymore, because it is not the case that all worlds are such that few windows are open. In particular w_2 violates this requirement.

(121) a. open windows in w_1: a, b

b. open windows in w_2: a, b, c

It is fairly clear what is going on. The context-sensitivity of quantifiers like *few* and *many* must not be taken into account when computing scalar implicatures and the strengthened meanings. Moreover, when evaluating whether a given inverse scope interpretation is allowed by the strengthened meaning of the surface scope or not, context also must not play a role. This suggests that the level where the proposed computations are taking place is what Fox (2000) and Gajewski (2002) refer to as *deductive system*. That is, at this level it is proven from the logical properties of the strengthened meaning of the surface scope alone that the inverse scope interpretation cannot be derived. For the latter, the deductive system, again, only has access to its logical properties.[34] In other words, if the deductive system can proof that there are situations where a contradiction would arise, it will block the inverse scope reading. Given that it does not have direct access to actual contextual information, it will consider all possible contexts against which the sentence might be evaluated later on in the semantic interpretation procedure.

The surface scope reading of (114) in contrast to the example just discussed has the alternatives in (122). Only q is stronger than p. q' is weaker than p, and q" is logically independent of p. The calculation of the scalar implicature therefore only takes q into account and arrives at the strengthened meaning of the surface scope in (123).

[34]For further applications of similar assumptions see Chierchia (1984), von Fintel (1992), Fox and Hackl (2006), and Magri (2009) a.o.

(122) a. p = Many windows are always open

b. q = All windows are always open

c. q' = Many windows are sometimes open

d. q" = All windows are sometimes open

(123) Many windows are such that they are always open and not all windows are such that they are always open

(123) of course does not contradict the inverse scope interpretation of (114), which says that it is always the case that many windows are open. As a consequence that inverse scope reading and its corresponding LF are free to be generated.

Consider now (124) and (125). Again, the inverse scope reading is only available with the UE-indefinite.

(124) More than three students are certain to pass, (i.e., it's certain that at least four pass) (more than 3 > certain) (certain > more than 3)

(125) Fewer than three students are certain to pass, (#i.e., it's certain that at most two pass) (fewer than 3 > certain) *(certain > fewer than 3)

Quantifiers such as *more than three* and *fewer than three*, although scalar in nature, evidently do not give rise to implicatures as discussed by Krifka (1999) and Fox and Hackl (2006). Consider the following example:

(126) John ate more than three cookies

If the alternative to (126) were *John ate more than four cookies*, its strengthened meaning would be *John ate more than three cookies and he didn't eat more than four cookies*, which is equivalent to *John ate exactly four cookies*. This, however, is not the meaning of (126). I will assume that there is a way to account for this fact. I refer the reader to Fox and Hackl (2006) for a detailed account. This means, I will pretend that the propositions resulting from replacing

more than three and *fewer than three* with their scale mates are not relevant as alternatives.[35] For our purposes the scalar implicature arising from *certain* is enough. The alternatives for the surface scope reading are as in (127). q is stronger than p.

(127) a. p = Fewer than three students are certain to pass

b. q = For fewer than three students it is possible that they pass

We get the strengthened meaning in (128).

(128) Fewer than three students are certain to pass and for at least three students it is possible that they pass

Let me give more precise truth conditions for (128) when applied to the actual world w. Assume that the function R is assigned by the assignment function g the meaning $\lambda w.\lambda w'.$*the circumstances of w hold in w′* (cf. (Fintel and Heim 2002:36) following Kratzer (1977)).

(129) $\exists x[\text{student}(x)_w \wedge |x| < 3 \wedge \forall w' \in W[g(R)(w)(w') = 1 \rightarrow \text{pass}(x)_{w'}]]$
$\wedge \exists x[\text{student}(x)_w \wedge |x| \geq 3 \wedge \exists w' \in W[g(R)(w)(w') = 1 \wedge \text{pass}(x)_{w'}]]$

When is (129) true? Assume a situation with ten students. Fewer than three students are such that they pass in all accessible worlds. But since this is a DE-quantifier, such students need not actually exist. The second line requires that at least three students are such that there is an accessible world for them where they pass. I.e., there must be a world where a, b, and c pass, say w_1 and w_2, respectively. This situation is depicted in (130).

(130) a. students who pass in w_1: a, b

[35] The actual set of alternatives for the surface scope of (124) is as in (127), and similarly for (125).

(i) a. p = More than three students are certain to pass
b. q = For more than three students it is possible that they pass
c. q' = More than four students are certain to pass
d. q" = For more than four students it is possible that they pass

b. students who pass in w_2: c

The lacking inverse scope interpretation of (125) would state that it is certain that fewer than three students pass, i.e., in each accessible world not more than two students pass (131). But (131) is true in the situation given in (130). That means that the inverse scope reading is not ruled out.

(131) $\forall w' \in W[g(R)(w)(w') \rightarrow \exists x[\text{student}(x)_w \wedge |x| < 3 \wedge \text{pass}(x)_{w'}]$

The apparent problem is that we are dealing with a DE-quantifier which does not guarantee that there are any students at all that pass. Moreover, the scale-mate *fewer than 2 students* was excluded as an alternative for the reasons discussed above. Essentially implicatures involving this alternative are never derived. But this is exactly what is missing in the present situation. Assume for a moment that in contrast to what I said above the alternative q' in (132c) is also available. Notice that it is stronger than p. In this case the strengthened interpretation is as in (133). A model satisfying this reading is given in (134b). In contrast to the truth-conditions before, we now have at least two individuals who pass in every world. This has the consequence that one world contains at least three individuals who pass. The inverse scope reading is thus not true anymore under these assumptions. Thus if it were possible to include q' as a possible alternative for p, we could derive why the inverse scope interpretation is absent. I do not know why we should be allowed to do so, however. I must leave this to further research. It might also be that complications such as the one just discussed make it possible to derive the inverse scope reading with modals after all. See the discussion above.

(132) a. p = Fewer than three students are certain to pass

b. q = For fewer than three students it is possible that they pass

c. q' = For fewer than two students it is certain that they pass

(133) Fewer than three students are certain to pass, for at least three it is possible that they pass, and for at least two it is certain that they pass.

(134) a. students who pass in w_1: a, b

b. students who pass in w_2: a, b, c

For (124) the alternatives to the surface scope reading are as in (135). However, q is weaker than p. The strengthened meaning of the surface scope is thus identical to its literal interpretation. There is no scalar implicature associated with the surface scope of that example. As such the inverse scope reading and the corresponding LF are free to surface.

(135) a. p = More than three students are such that they are certain to pass

b. q = More than three students are such that it is possible for them to pass

We have thus accounted for the difference between UE-indefinites and DE-indefinites with respect to their ability to undergo reconstruction with the same mechanism used in the preceding subsection.

We have seen that the absence or presence of inverse scope readings in basically all of the cases discussed in section 5.2 can be derived from the assumption that the surface scope gets strengthened by incorporating its scalar implicature – that is, ignoring the problematic (125), of course.

5.7.4 Contextual deviance again

Remember now the argument from subsection 5.3.2 regarding (136). It was suggested that the sentence sounds deviant in the given context, because the surface scope interpretation does not conform to our intuitions about driving exams, and the inverse scope reading is not available because of the GSEC.

(136) *Context:* Speaking about a driving exam that takes place every day.

#Fewer than three people from New York City always pass

#(fewer than 3 > always) *(always > fewer than 3)

What does the theory advanced in the present section have to say about cases like (136)? If our theory does not generate a strengthened meaning for the surface scope interpretation, the inverse scope reading should be available. Again, the assumptions made in the previous subsection come to help. Contextual knowledge should not play a role when generating strengthened meanings. It is only the purely logical properties of the strengthened meaning and of the inverse scope interpretation that matter when checking for the availability of a given inverse scope representation. The fact that contextual knowledge might rule out the surface scope at a later stage of interpretation on whose basis the strengthened meaning was derived should not matter at the level of the deductive system.

5.7.5 Embedding in DE-environments

Remember the following two sentences from subsection 5.5.1. The point made wrt. these examples was that we as speakers have direct access to inverse scope readings in cases where Truth Dominance would not predict so. In particular, the DE-environments in (137) and (139) cause the inverse scope interpretations to be strictly stronger than the surface scope interpretations of the embedded sentence. When the DE-inducing element is not taken into account, the reverse situation obtains, (138) and (140). That is, although the inverse scope interpretations are strictly stronger than the surface scope meanings in (137) and (139), they remain detectable.

(137) If a boy dances with every girl, the party will be a success $(\exists > \forall)(\forall > \exists)$

(138) A boy dances with every girl $(\exists > \forall)(\forall > \exists)$

(139) *Context:* John knows that the party was a success, in fact he is pretty sure that everyone showed up, but is perfectly sure that at least most showed up.
John doubts that every guest didn't show up

(140) Every guest didn't show up $(\forall > \neg)\ (\neg > \forall)$

But how would our theory of blocking by scalar implicatures account for these facts? If we follow the Neo-Gricean view, implicatures are always computed on the basis of the whole utterance, i.e., at the matrix level. The reason for this is that scalar implicatures are part of conversational reasoning which is something that speakers engage in when they hear an utterance, i.e., they are part of pragmatics in a strict sense. So if one hears a speaker utter the proposition p denoted by sentence S, one will derive a strengthened interpretation of p on the basis of the information relevant at the given point in the conversation. Crucially, though, sub-sentential levels are not available at this point anymore, because the compositional semantic component has already passed its information to the pragmatic component. The latter operates on the output of the compositional component, so to speak. But this means that also in the case of (137) the hearer of the sentence will derive a strengthened interpretation on the basis of the output of the semantic interpretation. It is not even clear how this view could exactly be stated for the present cases. But assume that the compositional semantics delivers p in (141a) as the interpretation of (137).[36] Then the hearer reasons on the basis of p and determines that the scalar alternatives of p should be as in (141b). The hearer then notes that p is strictly stronger than q. If the party will be a success under the condition that there is a boy who dances with every girl, then it surely will be a success if every boy dances with every girl. This means there is no stronger alternative to p and no strengthened interpretation is derived.

(141) a. p = If a boy is such that he dances with every girl, the party will be a success

b. q = If every boy is such that he dances with every girl, the party will be a success

Crucially, though, the non-strengthened surface scope interpretation p does not contradict the inverse scope interpretation, as it does not rule out the possibility that for every girl there is a boy who dances with her. I.e., when we generate the scalar implicatures on the basis of the

[36]The problem here is that if we let the grammatical component freely generate the interpretations associated with a sentence that is potentially scopally ambiguous, it is not clear at all why it cannot generate the LFs necessary for the unattested inverse scope interpretations. If it is the post-compositional component that is relevant for determining whether a given inverse scope interpretation is licensed or not, it seems that at least both the surface and the inverse scope LF must be available. But we saw that this is not the case.

whole sentence, we predict that the sentence in question should be scopally ambiguous. This is the correct result.

5.8 Characterization of the system

In the present subsection, I briefly discuss how the mechanism responsible for the effects observed above can be made more precise. Remember the proposal: The inverse scope interpretation of a potentially ambiguous sentence is only available, if the strengthened interpretation of the surface scope does not contradict it. Let us refer to the strengthened interpretation of a sentence S as $[\![S]\!]^S$. As a first approximation we can think of as $[\![S]\!]^S$ as being constituted by the ordinary interpretation of S, $[\![S]\!]$, plus its implicatures – i.e., plus the negation of stronger Horn-alternatives of $[\![S]\!]$, $\text{Alt}_S([\![S]\!])$. That is, $[\![S]\!]^S = [\![S]\!] + \neg\text{Alt}_S([\![S]\!])$. In section 5.6 scalar reasoning was described as a purely pragmatic process in which we essentially followed the Neo-Gricean perspective of how strengthened interpretations are derived. This in particular means that strengthened interpretations come about through conversational reasoning, which in turn means that it is part of the post-compositional part of grammar. The consequence of this is that the derivational history and compositional interpretation of a sentence should not be visible anymore to the system at this point. In other words, only the root of the sentence is accessible to which further information can be added, say, through conjunction.

There are two issues that have to be addressed at this point given the idea argued for in this chapter: First, it has to be recalled that it is essential for the present proposal to work that the inverse scope representation is not available when its interpretation contradicts the strengthened interpretation of the surface scope. But if we choose a Neo-Gricean perspective to account for the unavailability of certain readings, then it is not clear why this should be so. On this view the syntactic/semantic part of grammar would be free to generate meanings. Assume then it is the inverse scope interpretation that is generated for a given sentence, and that moreover this interpretation would be incompatible with the strengthened surface scope interpretation. But why should the particular interpretation be blocked in this situation? The Neo-Gricean

perspective applied to the present proposal would entail that the compositional system outputs two interpretations for an ambiguous sentence, one associated with surface surface and one with the inverse scope. Then conversational reasoning starts on the basis of the surface scope interpretation by enriching the basic meaning. If the strengthened interpretation of the surface scope is incompatible with the basic inverse scope interpretation, it is disregarded for further computation. This is reasonable so far. The problem, however, is that this has the consequence that the parallelism condition on VP-ellipsis must be stated as a pragmatic one, because only when the pragmatic part of the computation has been reached can it be determined whether a given inverse scope interpretation is blocked or not. It seems counter-intuitive that the pragmatic system should be responsible for such conditions.

The second potential problem for a Neo-Gricean view is that the present proposal relied on the assumption that contextual information does not enter the computation where it is checked whether an inverse scope meaning is blocked or not. But presumably pragmatics takes contextual information into account. Thus it is unclear why it could not do so in the present context. To be sure, one could argue that there is a stage in the pragmatic computation where such information is unavailable. But this would amount to introducing additional representational levels into the system. A system where it is not necessary to do so, is to be preferred to one where such levels are posited. Semantic interpretation, however, that evaluates syntactic information without recourse to contextual parameters would be exactly such a point in the system where one could state the relevant processes naturally. A similar argument is given in Magri (2009).

A deductive system and exhaustivity Let us follow recent claims in the literature that among the grammatical components is a deductive system (DS, Fox (2000), Gajewski (2002), Fox and Hackl (2006), Magri (2009), but also cf. Reinhart (2006)). This component provides representations of a syntactic input where only its logical information is present. Contextual information and real-world knowledge is immaterial at this stage of computation. Gajewski in particular argues that representations that lead to necessary contradictions or tautologies based on their logical operators alone, result in grammatical deviance. Contradictory statements that

are not so on the basis of their logical operators alone, on the other hand, do not lead to deviance. The same holds for tautologies. That is, a representation is deviant due to contradiction or tautology, if the syntactic representation in question with all its non-logical information ignored is provably contradictory or tautologous.[37] [38] But this is not quite enough yet to make the idea of this chapter work. To apply the reasoning just sketched to the present proposal would mean the following: An inverse scope interpretation is unavailable if the enriched strengthened meaning of the surface scope contradicts it. That is, the latter contradicts it given the logical information alone. But this entails that there is a way to factor in the implicatures of the surface scope before the pragmatic component. If a way can be found to do so, the first problem mentioned above is also addressed.

So let us assume with others that there is a grammatical device to generate strengthened interpretations. Following Chierchia (2006), Schulz and Van Rooij (2006), Fox (2007), Spector (2007), Chierchia et al. (2008) a.o., we assume that there is an exhaustivity operator O (Groenendijk and Stokhof 1984) that is responsible for the strengthening process. O is similar in its semantics to *only* (Rooth (1985, 1992b) in that it takes two arguments – i.e., a prejacent ϕ and set Alt which has the alternatives to the prejacent as its members – and negates all stronger alternatives to the prejacent. The difference to *only* is that O asserts rather than presupposes that the prejacent is true (Fox 2007). Assume the entry in (142) for O.

(142) $[\![\mathrm{O}]\!](Alt_{\langle\langle st\rangle t\rangle})(p_{\langle st\rangle})(w) = 1$ iff $p(w) = 1 \wedge \forall q \in Alt(p)[q(w) = 1 \rightarrow p \subseteq q]$

[37] As an argument for this view Gajewski cites von Fintel's 1993 arguments for the ungrammaticality of exceptive *but* with non-universal quantifiers. Given von Fintel's semantics for exceptive *but*, (141a) is contradictory because of its logical operators alone. (141b), on the other hand, is not contradictory due to any logical operator, although the statement the conclusion would is contradictory given world-knowledge. The sentence does not result in deviance in accordance with Gajewski's proposal ((i) cited from (Magri 2009:260)).

(i) a. #Some students but Bill passed the exam.
b. Your assumptions have got to be wrong, because they entail that ...
...Socrates is mortal and immortal.

[38] Note also that Fox's 2000 Scope Economy Condition cited in (1) above is also stated as a condition active at the level of DS.

(142) derives the strengthened interpretation of (143a) in (143c) through the LF in (143b). In other words it is assumed that O attaches to the root level.[39] Moreover O brings the alternative set Alt with it. For the present purposes it is assumed that Alt is equal to the set of alternatives derived by means of the Horn-alternatives. It would, however, be more accurate to equate Alt with a set of alternatives determined by focus. In this case, the actual members of the set are not only grammatically determined but also contextually dependent (cf. Rooth (1992b) and von Fintel (1994)). Since Alt(John read some of the books) is equal to the set {λw.John read some of the books in w, λw.John read all of the books in w} where the second member asymmetrically entails the first one, it follows that the strengthened interpretation in (143c) is equivalent to the statement in (143d).

(143) a. John read some of the books

b. O Alt [John read some of the books]

c. $[\![(143b)]\!](w) = 1$ iff John read some of the books in $w = 1 \wedge$
$\forall q \in Alt[q(w) = 1 \rightarrow \lambda w$.John read some of the books in $w \subseteq q]$

d. 'John read some of the books, but not all of them.'

How would this mechanism deal with the phenomena covered by the present proposal? We are assuming that DS is the relevant level at which the process envisioned should be stated. Consider again our example (8) repeated in (144). Someone who hears (144) entertains the two possible LFs in (145) where the first corresponds to the surface scope and the second to the inverse scope configuration.

(144) John didn't meet every student of mine $(\neg > \forall)$ $*(\forall > \neg)$

(145) a. not [every student 1[John met t_1]]

b. every student 1[not [John met t_1]]

[39]Note that strictly speaking this LF constitutes only one of the possibilities. It is also possible that O is inserted at the non-root level. This leads to a different interpretation. The placement of O is subject to pragmatic considerations. For discussion of this point see Chierchia et al. (2008) and for criticism a.o. Geurts and Pouscoulous (2009). We will come back to this point below.

Now the process starts that checks whether the inverse scope LF is to be further entertained by the speaker or not. DS augments the surface scope LF (145a) by adding O at the root level. Alt is equal to the set {$\lambda w.\neg\forall x$[student(x) $\rightarrow$ met(John,x) in w, $\lambda w.\neg\exists x$[student(x) $\rightarrow$ met(John,x) in w} where the second member asymmetrically entails the first one. Let us now turn to the interpretation (146b). Since the entailment relations are as just stated, the second alternative must be false in world w. This in turn means there must be a student that John met. Thus (146b) can be paraphrased as in (146c).

(146) a. O Alt [not [every student 1[John met t_1]]]

b. $[\![(146a)]\!](w) = 1$ iff $\neg\forall x[\text{student}(x)(w) \rightarrow \text{met}(\text{John},x)(w)] = 1 \wedge$
$\forall q \in Alt[(q(w) = 1 \rightarrow \lambda w.\neg\forall x[\text{student}(x)(w) \rightarrow \text{met}(\text{John},x)(w)] \subseteq q]$

c. 'Not all students are such that John met them, but there is at least one that he met.'

The non-strengthened interpretation of (145b), on the other hand, is as in (147).[40]

(147) $[\![(145b)]\!](w) = 1$ iff $\forall x[\text{student}(x)(w) \rightarrow \neg\text{met}(\text{John},x)(w)]$

It is obvious that the strengthened interpretation of the surface scope in (146b) contradicts the inverse scope meaning (147). The inverse scope interpretation is now blocked due to the contradiction. I.e., DS filters the inverse scope meaning and a speaker therefore intuits (144) as scopally unambiguous. We can thus think of the described process as a grammaticalized means to reduce scope possibilities. If the inverse scope interpretation is not overall consistent, i.e., consistent with the enriched surface scope meaning, it is not passed on by DS for further computation. Note, however, that it is never the case that an inverse scope interpretation blocks a surface scope meaning. A case in point is example (7) repeated as (148). Here the strength-

[40] In fact the strengthened interpretation of (145b) is equivalent to the non-strengthened version. This is so, because the scalar item *every* is in a non-DE-environment. Thus the proposition corresponding to (145b) is the strongest of the alternatives. Therefore it does not make a difference wether the strengthened or the non-strengthened interpretation is considered for this particular example. It can be checked that the other examples discussed exhibit a parallel behavior.

ened surface scope is equivalent to the non-strengthened one, as the proposition associated with the surface scope is the strongest alternative. When we compute the strengthened inverse scope meaning, on the other hand, the statement that not every, but some student showed up is derived. This contradicts the surface scope interpretation. Nevertheless, the sentence in (148) is felt to be scopally ambiguous. We can hypothesize that this is due to some constraint that interpretations corresponding to overt word order cannot be blocked. It would be uneconomical to utter a sentence whose overtly stated scope is never to be considered at all.

(148) Every student of mine didn't show up $(\forall > \neg)$ $(\neg > \forall)$

We can therefore think of DS as a process that strives to reduce inverse scope possibilities whenever possible, possibly because entertaining inverse scope interpretations is computationally costly.

5.9 Conclusion

The present chapter provided evidence that the relative strength of surface and inverse scope readings plays a role in the theory of grammar. In particular, it was argued that CSSOs leading to interpretations equivalent to or strictly stronger than the surface scope reading are ruled out. In other words, the LF necessary for the inverse scope interpretation in not generated in such cases. I gave a number of different arguments for this view and showed that competing pragmatic principles such as Truth Dominance cannot account for the full range of data. Furthermore we hope to have shown that data that seem to provide counter-examples at first sight actually turn out to support the present approach. In the second half of the chapter, I related this empirical generalization to the theory of scalar implicatures. I suggested that the grammar obligatorily generates a strengthened meaning of the surface scope that contradicts the inverse scope interpretation in the relevant examples. Because of this the necessary inverse scope LF is also not generated. This lends evidence to the view that certain parts of language are logically governed.

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