13. Quantification and Information Structure

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Abstract. The article provides an overview of the interaction between quantification and information-structural properties, especially focus, givenness, and topic. After a short introduction into the nature of quantification, it covers the main areas where such interactions have been identified in the last thirty years in adverbial quantification and in nominal (oder determiner) quantification. It also discusses cases in which the quantifier itself is topical, given, or focused.

Key words: Quantification, Determiners, Focus, Topic, Givenness, Scope, Presupposition

13.1 What is quantification?
And why is it relevant for Information Structure?

In linguistic semantics, the term **quantification** refers to evaluating the relation of two sets, prototypically expressed by quantificational determiners like *every, some, n o* or *most*. This is illustrated in the following examples; imagine a set of dice of different colors, some of which might be loaded.

(1) a. *Every black die is loaded.* ⟦*black die*⟧ ⊆ ⟦*loaded*⟧
  b. *Some black die is loaded.* ⟦*black die*⟧ ∩ ⟦*loaded*⟧ ≠ ∅
  c. *Most black dice are loaded.* #(⟦*black die*⟧ ∩ ⟦*loaded*⟧) > ½ #(⟦*black die*⟧)

If α is an expression, ⟦α⟧ stands for the truth-conditional meaning of α; ⟦*black die*⟧ is the set of black dice, and ⟦*loaded*⟧ is the set of loaded objects. Quantificational determiners express relations between the two sets, e.g. *every,* the subset relation. The NP *black die* is called **restrictor**, and the VP *loaded*, (**nuclear**) **scope** or **matrix**. Quantificational statements like (1) are further restricted to the entities being talked about (like the dice under investigation); this is the **domain** of quantification, which can be specified, e.g. *as far as these dice are concerned*, but it is often left implicit.

(2) ⟦*Every black die is loaded.*⟧$^{\text{DOM}}$ is true iff [⟦*black die*⟧ ∩ DOM] ⊆ ⟦*loaded*⟧

Quantifiers have been studied in **Generalized Quantifier** theory (cf. Barwise & Cooper 1981; for recent overviews Szabolcsi 2010, Keenan 2011; for typological treatments Matthewson (ed.) 2008, Keenan & Paperno (eds.) 2012). They increase the expressive power of human languages compared to languages that only have referential DPs, like *John* or *the thief*. Human language also exceeds the expressive power of first-order predicate logic, which has two (interdefinable) quantifiers, existential ∃ and universal ∀, which would not be able to express (1)(c).

The examples in (1) differ in their truth conditions. So, why have a chapter on quantification in this handbook, as information structure is concerned with the way how information is presented, or "packaged," in the sense of Chafe 1976? Because the marking devices of information-structural features like focus, givenness, and topic influence the interpretation of quantificational clauses (cf. Partee 1991, Partee, 1999). This can be seen best with a type of quantification not expressed by determiners (called **D-quantification**), but by adverbial quantifiers like *always*, generic sentences, or modal operators like *must* (called **A-quantification**; cf. Bach et al. 1995). In the following example, the stress pattern, normally expressing focus, leads to truth-conditional differences.

(3)　　a. *Always, a black die is LOADED.*　　$[\![black\ die]\!] \subseteq [\![loaded]\!]$
　　　　b. *Always, a BLACK die is loaded.*　　$[\![loaded]\!] \subseteq [\![black\ die]\!]$

The effects of stress in quantificational statements have been observed by various authors. Halliday 1970 noticed it with modal statements. The warning sign *Dogs must be carried* gets the unintended reading that the escalator is only for dog-holders with stress on *dogs*. Sgall e.a. 1987 pointed it out for clauses with frequency adverbials, as in *Londoners most often go to Brighton*, which gets different truth conditions with stress on LONDONERS ('all Brighton visitors are Londoners') or BRIGHTON ('all visits by Londoners are to Brighton'). Krifka e.a. 1995 attended to ambiguities in generic sentences as in *Typhoons arise in the Pacific*, which are a generic statement about typhoons with stress on PACIFIC, and about the Pacific with stress on TYPHOONS (cf. also Cohen & Erteschik-Shir 2002).

There is one important finding of generalized quantifier theory that will play an important role, **conservativity**. According to Keenan & Stavi 1986, it is sufficient for judging the truth of a D-quantificational statement to consider the entities in the restrictor, which is given by the NP argument. For (1), it is sufficient to check the black dice; other entities such as the white dice or the roulette wheels are irrelevant. The restrictor indicates the entities that the sentence is **about** (here, the black dice). This corresponds to the notion of **topic**, whereas the nuclear scope corresponds to the notion of **comment**.

With D-quantifiers, the syntactic structure $[[_{DP}\ D\ NP]\ VP]$ indicates how the clause should be evaluated: NP is the restrictor, VP the nuclear scope, and D expresses the relation between restrictor and nuclear scope. With A-quantifiers as in (3), the identification of restrictor and nuclear scope is supported by prosodic means or syntactic movement, like scrambling, see below. Configurations of quantifier, restrictor and nuclear scope have been called **tripartite structures** by Partee 1981 and Heim 1982.

There are certain phenomena relating to quantification that are treated in other articles of this handbook. In particular, Chapter 12 treats particles like *only, also* and *even* that have quantificational force. And Chapter 3 treats phenomena relating to definite and indefinite DPs that have quantificational effects on the level of discourse.

13.2 Information Structure in A-Quantification

13.2.1 Focus Effects in a Situation-Based Theory

Adverbial quantifiers, as observed in (3), have been analyzed as quantifying over times, cases, or situations (cf. e.g. Lewis 1975). Their restrictor can be provided by a *when*-clause. Assuming situations (cf. von Fintel 1994), we can illustrate this as follows:

(4) *When Mary goes to the movies, she always invites John to go along with her.*
  $\llbracket Mary\ goes\ to\ the\ movies \rrbracket \subseteq \llbracket Mary\ invites\ John\ to\ go\ along\ with\ her \rrbracket$
  = {s | Mary goes to the movies in s} $\subseteq$ {s | Mary invites John to go with her in s}

Rooth 1985 explains the influence of information structure on quantification as an effect of **focus**, understood as indicating alternative meanings that play a role in semantic interpretation (cf. Chapter 2). In addition to the regular meaning $\llbracket \alpha \rrbracket$ there is a focus meaning $\llbracket \alpha \rrbracket^f$, a set of meanings of the same type, which is relevant for the interpretation of certain operators, including adverbial quantification:

(5) *Mary always takes JOHN$_F$ to the movies.*
  'Every situation in which Mary takes someone to the movies, it is John.'

(6) *MARY$_F$ always takes John to the movies.*
  'Every situation in which someone takes John to the movies, it is Mary.'

The regular and the focus meaning of (5) without *always* are as follows:

(7) a. $\llbracket (5) \rrbracket$ = {s | Mary takes John to the movies in s}
   b. $\llbracket (5) \rrbracket^f$ = {{s | Mary takes x to the movies in s} | x ∈ PERSON}
       = {S | ∃x ∈ PERSON[S = {s | Mary takes x to the movies in s}]}

The restrictor is provided by the **union of the focus meaning**, $\cup \llbracket \alpha \rrbracket^f$. With *always* we get the following interpretation for (5):

(8) $\cup \llbracket (5) \rrbracket^f \subseteq \llbracket (5) \rrbracket$
  = {s | ∃x ∈ PERSON[M. takes x to the m. in s]} $\subseteq$ {s | M. takes John to the m. in s}

For (6) this would result in the following interpretation:

(9) {s | ∃x ∈ PERSON[x takes J. to the m. in s]} $\subseteq$ {s | Mary takes J. to the m. in s}

This represents the intended reading, but at the price of assuming different ways in which adverbial quantifiers are interpreted: In (4) the restrictor is provided by a *when*-clause, in (5)/(6) by the focus meaning.

13.2.2 Focus Effects Mediated via Context

Starting with Rooth 1992, focus effects were seen as mediated through context, thus leading to an overall more restrictive theory of how focus influences interpretation; von Fintel 1994 carried this out for A-quantification. Previous work by Kasper 1987, Schubert & Pelletier 1987, and Berman 1989 had suggested that the **presuppositions** of a clause form the restrictor of an A-quantifier. This is illustrated by (10), where *hit the target* presupposes that the subject aims and shoots at a target.

(10) *Robin Hood always hits the target.*
  {s | RH aims and shoots at a target in s} $\subseteq$ {s | RH hits the target in s}

Presupposition is a form of givenness, an information-structural notion (). The focus structure gives a linguistic clue about the kinds of situation talked about, which in turn influences quantificational statements. Von Fintel takes up a device introduced by Rooth 1992 for context-sensitivity: The alternatives at the propositional level that are introduced by focus restrict a contextual parameter C, which is related to the clause by a squiggle operator ~:

(11) $[\![\varphi \sim C]\!] = [\![\varphi]\!]$, provided that $[\![C]\!] \subseteq [\![\varphi]\!]^f$.

C is interpreted as a subset of the focus alternatives $[\![\varphi]\!]^f$ (von Fintel also requires that $[\![\varphi]\!]$ and at least one other element must be in $[\![C]\!]$). C is further constrained by the presuppositions of the clause, by a *when*-clause, or by the discourse topic of the sentence. With adverbial quantification, C determines the restrictor. Consequently, focus is just one of the factors restricting the domain of quantification. Consider (12):

(12) $[\![[When Mary feels lonely [[she always takes JOHN_F to the movies] \sim C]]]\!]$
        true iff $\cup[\![C]\!] \subseteq [\![Mary takes JOHN_F to the movies]\!]$,
        provided $[\![C]\!] \subseteq [\![Mary feels lonely]\!]$, $[\![C]\!] \subseteq [\![Mary takes JOHN_F to the movie s]\!]^f$

This states that in all situations s in $\cup[\![C]\!]$, Mary takes John to the movies. As C is not explicitly restricted further, we should take it to be the maximal set satisfying the provision, which results in the intended reading: Whenever Mary feels lonely and takes someone to the movies, she takes John. C can be restricted further by the context, e.g. by the leading question (13), in which case the interpretation would be appropriately restricted to situations in which Mary takes John, Bill, or Sam to the movies.

(13) $[\![Who does Mary take to the movies, John, Bill, or Sam?]\!]$
        $= \{\{s \mid M. \text{ takes } x \text{ to the movies}\} \mid x \in PERSON, x=John \lor x = Bill \lor x = Sam\}$

Beaver & Clark 2008 distinguish three ways of how focus can affect meaning: **quasi association**, where a non-veridical propositional operator like negation applies to a proposition, which in turn has to be an answer to a question under discussion; **free association**, where an operator depends on the setting of a contextual variable; and **conventionalized association**, as with additive and scalar particles like *also, only* and *even*, where association with focus arguably is hard-wired into the grammar. Quantification belongs to the second kind: Focus helps to restrict a domain variable, which then is intersected with the restrictor of a quantifier (cf. de Hoop & Solà 1996 for a related proposal). Other constructions whose interpretation depends in similar ways on focus are superlatives like MARY_F *gave John the biggest box* (= Mary gave a bigger box to John than anyone else gave to him) and emotive factives like *The students were glad that* BRADY_F *taught semantics.* (= The students preferred Brady over another person to teach semantics). But for quantifiers, Beaver & Clark 2008 make the point that their focus dependency cannot be explained by mere sensitivity to presupposition, as has been argued in the light of examples like (10) by Rooth 1999 and Cohen 1999. Consider (14).

(14)   (a) *Every Friday Sandy goes to town.* (b) *She always realizes that the Harley Davidson she is riding there is going to attract a lot of attention.*

Realize is factive, hence (14)(b) presupposes that Sandy rides a Harley Davidson to town and attracts a lot of attention. If this presupposition would restrict the domain of *always*, then (b) should mean 'Whenever Sandy is riding a Harley Davidson and it attracts a lot of attention, then Sandy realizes that it attracts a lot of attention'. (14)(b)

does not have this meaning. Beaver & Clark argue that (14)(a) introduces a set of situations of Sandy going to town, one for each Friday, that cannot be reduced further by the presupposition of the following sentence. Rather, this presupposition is accommodated: We understand (14) as saying that every Friday situation that Sandy goes to town is a situation in which her Harley Davidson attracts a lot of attention.

The resulting picture then is as follows: Quantification depends on a given set of situations, and the presuppositions within the quantified sentence corresponds to that set of given situations. Focus in turn helps to determine the presuppositions of the sentence, by the union over the alternatives of the focus. We do not have to stipulate a direct relation between quantification and focus.

13.2.3   The Requantification Problem

Von Fintel 1994 notices a problem with quantification over situations which arises with indefinite DPs. Consider (15).

(15)   *A cowboy always chews TOBACCO*$_F$.
   $\{s \mid \exists y \exists x[\text{cowboy}(x) \wedge x \text{ chews } y \text{ in } s]\}$
   $\subseteq \{s \mid \exists x[\text{cowboy}(x) \wedge x \text{ chews tobacco in } s]\}$

We understand this as: When a cowboy chews something, he chews tobacco. But the representation given actually states: For any situation s, if there is a cowboy that chews something in s, then there is a cowboy (potentially another one!) that chews tobacco in s. For this, a situation s would constitute a positive instance in which one cowboy chews tobacco, and nine others chew bubble gum. We cannot achieve binding between the x in the restrictor and the x in the scope. This is the **requantification** problem.

Von Fintel 1994 suggests that we quantify over **minimal** situations in the restrictor and in the scope (cf. also Berman 1987, Heim 1990, Elbourne, 2005): Each minimal situation s in which a cowboy smokes something is a minimal situation in which a cowboy smokes tobacco. This strategy gives us the right truth conditions. But it enforces to assume identity between the two cats in (16):

(16)   *Always, if a cat is hungry, a cat cries*.

This interpretation might be possible (von Fintel discusses examples like *Show me a man who plays hard and I show you a man who deserves a beer*). But clearly, (16) invites the reading 'If a cat x is hungry, then there is a distinct cat y such that y cries'.

The problem does not go away in a dynamic framework that is designed to capture the introduction and uptake of discourse referents, such as Heim 1982 or Kamp 1981. If we adapt the interpretation rules for focus and A-quantifiers to such a framework, as in Rooth 1995, then *a cowboy* in the scope in (15) would require the introduction of a novel discourse referent, leading to the wrong interpretation. Rooth's solution is to relax the novelty condition and allow for the index to be in the input meaning. However, this creates problems in cases like (16), where we actually want the indefinite DP in the scope to come with the novelty condition.

Hinterwimmer & Schueler 2012 propose that sentences like (15) are not about situations, but events. As the participants have unique roles in events, we do not need any reference to minimal situations: For any event e of chewing, there is a unique agent, and hence the agent of the event in the restrictor and the agent of the event in the scope must

be the same. (16) is different: There are two clauses, which allows for the agent of the first event (being hungry) and the agent of the second (crying) to be different. Hinterwimmer & Schueler 2012 also discuss (17)(a) in which the indefinite DP in the scope is interpreted as co-referent with the indefinite DP in the restrictor, in contrast to (b).

(17) a. *When Alan PRAISES a student, he always praises a SMART student.*
     b. *When Alan talks to a student, he always PRAISES a student.*

They argue that in case the predicate in the restrictor and the scope is the same, as *praise* in (17)(a), there is a tendency that they pick out the same event; this is not the case if the predicates are different, as in (b). In addition, as the descriptive part of the indefinite in the scope is partly novel in (a), the speaker could not use a pronoun or a definite description, and so there is no pragmatic inference that the two entities are distinct.

13.2.4 Givenness in a Representation based on Discourse Referents

Chierchia 1995 and Krifka 2001a propose that it is **givenness**, not focus, which affects adverbial quantification. They analyze the accentual pattern of (15) as the result of deaccentuation of *a cowboy*.

(18) [*A cowboy*]$_G$ *always smokes TOBACCO.*

The contextual effects of adverbial quantification discussed in 13.2.2 can be explained in terms of givenness, as it is inversely related to focus (cf. Schwarzschild 1999). Krifka argues that this solves the requantification problem if we assume that adverbial quantification involves discourse referents anchored to entities. Givenness implies that the entity referred to is already present in the context (cf. Chapter 3). Now, the discourse referent of a given indefinite as in (18) is obviously not present, as then a pronoun or definite DP would have been used. Krifka calls such indefinites **non-novel**, and assumes that they trigger **accommodation** of a context in which they are given. The quantifier *always* then states that each way in which the context can be accommodated makes the sentence true.

(19) Every way in which the context can be accommodated
     such that [*a cowboy*]$_{G,i}$ *smokes tobacco* can be interpreted,
       − i.e. every way to anchor a discourse referent i to some cowboy or other,
     is also a way that makes the sentence [*a cowboy*]$_{G,j}$ *smokes tobacco* is true,
       − i.e. it also holds that i is anchored to a cowboy that smokes tobacco.

For support of the givenness analysis, Krifka points out that non-novel indefinites can be marked by the word *given*, and that they carry other givenness markings, e.g. they are marked as topics in Japanese.

(20) *The fact that a <u>given</u> phenomenon is successfully predicted by a theory does not prove the theory to be correct.*

(21) *taitei,   midori no   me o   shita inu wa rikou   de   aru*
     usually green   GEN eye ACC did   dog TOP intelligent DECL is
     'Usually, a green-eyed dog is intelligent.'

Furthermore, **scrambling** in languages like German can be interpreted as evidence for givenness of indefinite DPs that yields a restrictor for A-quantifiers (cf. Chapter 19). This has been argued for by Diesing 1992 with data like the following:

(22) a. *weil* [$_{IP}$ *doch   gewöhnlich* [$_{VP}$ Kɪɴᴅᴇʀ *auf der Straße spielen*]]
    because PARTICLE usually   children on the street   play
    'because there usually are children playing on the street'

  b. *weil* [$_{IP}$ *Kinder$_i$ doch gewöhnlich* [$_{VP}$ t$_i$ *auf der Sᴛʀᴀssᴇ spielen*]]
    'because children usually play on the street'

Finally, accommodated indefinites support **cataphora**, as in *If a ᴠᴇɢᴇᴛᴀʀɪᴀɴ owns <u>it</u>, he usually takes good ᴄᴀʀᴇ of [a donkey]*$_G$. This is to be expected if their antecedent is given (cf. Reinhart 1986).

One argument for the analysis based on discourse referents over situation- or event-based theories relates to stative predicates, as in (23). This is a statement about square numbers, not about situations containing such numbers, whatever this should be.

(23) *A square number can end only with digits 1, 4, 6, 9, 00, or 25.*

Krifka also considers non-novel indefinites in the restrictor of biclausal quantificational sentences, arguing that they trigger accommodation of their discourse referent as well.

(24) *If a ᴠᴇɢᴇᴛᴀʀɪᴀɴ owns* [*a donkey*]$_G$, *he usually takes good ᴄᴀʀᴇ of it.*
    'Most donkeys owned by a vegetarian are taken good care of by him.'

(24) asymmetrically quantifies over donkeys (cf. Kadmon 1987), which is indicated by deaccenting *a donkey*. This reading can be achieved if we assume that its discourse referent is accommodated, and *usually* quantifies over accommodations: Most ways to accommodate the context such that x is a donkey support the following: if a vegetarian owns x, he takes good care of x.

13.3 Information Structure in D-quantification

13.3.1 D-Quantification over Situations

While information-structure effect have been initially discussed with A-quantification, they also affect sentences with D-quantification. Krifka 1990 discusses D-quantifiers that involve quantification over events as in (25), and Geilfuß-Wolfgang 1995 and Eckardt 1999 treat examples like (26) in detail.

(25) *Every ship passed through the lock at ɴɪɢʜᴛ.*
    'Every ship passing through the lock occurred night.'

(26) *Most tickets were sold at checker ғᴏᴜʀ.*
    'Most tickets that were sold were sold at checker four.'

Geilfuß-Wolfgang 1995 develops an analysis in which the focus in the scope affects the nominal complement of the quantificational determiner. Assume that MOST expresses the relation between two sets A, B that holds if #(A∩B) > ½ #(A), cf. (1)(d), then we have the following interpretation for (26). Just as with A-quantification, the restrictor is determined by a combination of factors, here the NP argument of the determiner and the focus of the nuclear scope.

(27) MOST([[*tickets*]] ∩ ∪[[*were sold at checker ғᴏᴜʀ*$_F$]]^f, [[*were sold at checker four*]])
    = MOST({x | x is a ticket} ∩ {x |x was sold at some checker},
          {x | x was sold at checker four})

In (26) quantification appears to be over entities (tickets). However, as each ticket is sold exactly once, it may be that quantification is over events. Eckardt 1999 takes up this issue with examples like (28).

(28) *Ludwig washed most cars with X-polish*$_F$.
    'Most cars that Ludwig washed he washed with X-Polish'

This cannot simply be understood as a quantification over cars that Ludwig washed: If Ludwig has 10 cars and washes 6 once with X-Polish, and washes 2 others 50 times with another product, (28) is not an appropriate description. It is also not just the washing events that count: If Ludwig washes one of his cars 50 times with X-polish, and 6 of it once with some other product, (28) does not seem to be true either. Eckardt suggests that such sentences suggest a one-to-one mapping between entities and events; in our case, that each car was washed exactly once. Hence focus sensitivity appears to be a property of event or situation quantification, even with D-quantifiers.

13.3.2 Information Structure Effects in the Restrictor: *Many* and *Few*

Focus does not only influence D-quantification in the scope of the quantifier, but also in the nuclear scope. This was first pointed out by Herburger 1993, 1997, based on an observation in Westerståhl 1985, with examples like the following:

(29) *Many S*CANDINAVIANS$_F$ *won the Nobel price in literature.*
    'Many winners of the Nobel price in literature were Scandinavians'

(30) *Few* COOKS$_F$ *applied.*
    'Few applicants were cooks.'

The usual restrictor-scope relation appears to be **reversed**; now the nominal complement determines the scope, and verbal predicate the restrictor. Hence, such uses of quantifiers do not satisfy conservativity. Herburger also showed that in cases when part of the restrictor is focused, the non-focused parts remains in the restrictor, resulting in a compositionality problem.

(31) *Few [*INCOMPETENT$_F$ *cooks] applied.*
    'Few of the applicants that were cooks were incompetent.'

The phenomenon occurs with *few* and *many*; it does not show up with *every* or *most*:

(32) *Many* INCOMPETENT$_F$ *cooks applied.*
    'Many of the applicants that were cooks were incompetent.'

(33) *Most* INCOMPETENT$_F$ *cooks applied.*
    Not: 'Most of the applicants that were cooks were incompentent'

Herburger 1997 argues that the determiners for which it obtains must be **weak** in the sense of Milsark 1974: They must form quantificational sentences that can occur as subjects of there-sentences (cf. *There were many cooks among the applicants* vs. **There were most cooks among the applicants*). Such determiners are **intersective**, that is, the truth condition of [[D NP] VP] can be stated as a condition on the intersection ⟦NP⟧ ∩ ⟦VP⟧ (cf. Keenan 2003). Intersective quantifiers are **symmetric**, that is, the truth conditions of [[D α] β] are the same as for [[D β] α], hence the distinction between restrictor and scope becomes irrelevant. Consequently, the syntactic position of the determiner D is no longer required to identify the restrictor. Herburger suggests that there are two

construals of clauses, one in which the determiner phrase DP takes scope, with the nominal complement as restrictorl, and one in which the determiner D raises and takes scope over the nominal complement and the restrictor, interpreted conjunctively.

(34) a. [*few* [*incompetent cooks*]] [x *applied*]
 b. [*few* [[x *incompetent cooks*] [x *applied*]]

(34)(b) expresses the **unary** reading of the quantifier that also occurs in *there*-sentences, as in (35). In this, the determiner is a cardinality predicate on a set – here, that the set {x | x is a child ∧ x is playing} contains many / three elements.

(35) *There were many / three children playing.*
 [*many / three* [[x *children*] [x *playing*]]

In (34)(b) there is no syntactically marked restrictor, hence focus will affect the interpretation just as with A-quantification. When we analyze a case with focus on *incompetent* following Rooth 1985, we get the reading in (36), where we assume that the alternative to *incompetent* is *competent*.

(36) ⟦[*few* [INCOMPETENT$_F$ *cooks applied*]]⟧
 = FEW(∪⟦INCOMPETENT$_F$ *cooks applied*⟧^{f}, ⟦INCOMPETENT$_F$ *cooks applied*⟧)
 = FEW({x | x is a competent or incompetent cook ∧ x applied},
   {x | x is an incompetent cook ∧ x applied})

This corresponds to the paraphrase given in (31). The approach extends naturally to cases in which the focus is located within the verbal constituent:

(37) ⟦[*few* [*competent cooks applied* LATE$_F$]]⟧
 = FEW({x | x is a competent cook ∧ x applied at some time or other}
   {x | x is a competent cook ∧ x applied late})

We also can deal with cases of multiple focus spread over the nominal complement of the determiner and the verbal predicate. The resulting meaning is that under the cooks that applied, the number of competent late-appliers was low.

(38) ⟦[*few* [COMPETENT$_F$ *cooks applied* LATE$_F$]]⟧
 = FEW({x |x is a competent or incompetent cook ∧ x applied some time or other}
   {x |x is a competent cook ∧ x applied late})

Herburger's analysis has been criticized by Büring 1996, de Hoop & Solà 1996, Cohen 2001, and Beaver & Clark 2008. In particular, the syntactic structure (36) does not correspond to the fact that syntactically, *few* is a nominal determiner, resulting in a D-Quantifier, not an adverbial or A-Quantifier. As an alternative, Büring (1996) suggest the following general scheme for the interpretation of an expression with focus:

(39) [… F ...] is true iff F, rather / to a higher degree than an alternative A, make [… X …] true.

Notice that according to (39), focus is not bound by the quantifier; rather, it is a general interpretation scheme for focus effects.

(40) [[*many* INCOMPETENT$_F$ *cooks*] *applied*] is true iff *incompetent*, rather than / to a higher degree than *competent*, makes [*many X cooks applied*] true.

(40) holds if *many incompetent cooks applied* is judged true, whereas *many competent cooks applied* is not judged true, or true to a lesser degree. This asks us to compare the following two statements:

(41) a. 'the number of incompetent cooks that applied is higher than expected'
      b. 'the number of competent cooks that applied is higher than expected'

(40) says that *many* INCOMPETENT$_F$ *cooks applied* is true iff (41)(a) holds, but (b) does not hold to the same degree. This results in the correct interpretation. The sentence asserts that the number of incompetent ones among the cooks that applied was higher than expected, not that the number of competent cooks that applied was higher than expected.

Herburger 1997 wrongly predicts similar effects for other intersective quantifiers. Focus does not seem to have an influence on truth conditions in (42).

(42) *Three* INCOMPETENT$_F$ *cooks applied.*

Büring 1996 has the same problem, as the interpretation scheme (39) is compatible with quantifiers like *three* as well.

What is special for *many* and *few*? As argued by Lappin 1988, these quantifiers are **comparative**. Solt 2009 analyzes them as dimensional adjectives like *big* and *small* that relate individuals to a standard value of a scale that is dependent on some comparison class. The comparison class required for the interpretation of *many* and *few* is delivered by the restrictor of the quantifier, which dependens on focus alternatives. This kind of sensitivity to the alternatives provided by focus shows up in sentences involving the *as compared to* construction:

(43) *Few / many / *three* COOKS$_F$ *applied, as compared to someliers or pastry chefs*.

The analysis Solt proposes for *few* COOKS$_F$ *applied* amounts to (44) when referring to focus alternatives, where ∪⟦*COOKS$_F$*⟧^{f} is the union of the alternatives, here ⟦*cook*⟧ ∪ ⟦*somelier*⟧ ∪ ⟦*pastry chef*⟧.

(44) $\#(⟦COOK_F⟧ ∩ ⟦applied⟧) << [\#(⟦COOK_F⟧) / \#(∪⟦COOK_F⟧^f)] × \#(∪⟦COOK_F⟧^f ∩ ⟦applied⟧)$

This states that the number of cooks that applied is considerably smaller than to be expected, given the proportion of cooks among the set of alternatives. For example, assume that among the alternative set ∪⟦*COOK$_F$*⟧^{f}, there are 80% cooks, 10% someliers, and 10% pastry chefs, and that there were 10 applicants, of which 5 were cooks, 4 were someliers, and one, a pastry chef. Under these circumstances, Solt's analysis predicts that *Few* COOKS$_F$ *applied* is true, as 5 << 0.8 × 10 and *Many* SOMELIERS$_F$ *applied* is true, as 4 >> 0.1 × 10. This is correct, even though there were more cooks that applied than there were someliers. Notice, also, that (44) represents not a proportional reading, but a cardinal reading of *few / many*, a point that is argued to be correct by Solt as well.

13.3.3 Information-Structure Effects with Proportional Determiners

Sauerland (2014) also discusses cases in which focus affects the interpretation of D-quantifiers; interestingly, this involves **proportional** quantifiers that are not intersective like *many* and *few*. The phenomenon was first recognized for Korean by Park 2007; related effects are observed in French and (for non-subject quantifiers) in English as in (45), a newspaper headline. Sauerland discusses German cases like (46).

(45) *Most recent class of NASA astronauts consists of 50% women.*

(46) a. *60 Prozent* (*der*) *Frauen haben gewählt.*
     60 percent   (of.the) women   have   voted
     '60 percent of the women have voted.'

   b. *60 Prozent FRAUEN_F haben gewählt.*
     '60 percent of the voters were women.'

Sauerland argues with case and agreement facts that that the syntactic structure of the DPs is different: In (46)(a) it is [_DP *60* [_D' [_D *Prozent*] [_DP *(der) Frauen*]]], whereas in (b), [_DP [_DP *60 Prozent*] [_NP *Frauen*]]. He assumes that (46)(b) allows for an interpretation like in Herburger's analysis (34)(b), yielding the logical form (47):

(47) [[_DP *60 Prozent*] [_S [_NP *FRAUEN*]_F [_VP *haben gewählt*]]].

The availability of (47) corresponds to the fact that in (46)(b), the DP *60 Prozent* and the NP *Frauen* seems to be more losely connected, and rather ambiguous as to which constituent forms the head. This structure is made clear with the alternative (48), in which the quantifier is expressed by an adverbial.

(48) [_PP *Zu 60 Prozent*] *haben FRAUEN_F gewählt.*
       to 60 percent   have   women   voted

In (47) the union of the focus meaning can determine the restrictor of the quantificational DP, *60 Prozent*. similar as with *few* in (36): '60 percent of the men or women that voted were women'. In spite of these parallels, it is not clear whether focus sensitivity of *many/few* and proportional quantifiers is the same phenomenon, given the problems of Herburger's original analysis, and its crucial assumption that the determiners it applies to are intersective, not proportional.

13.3.4   Focus-sensitive Determiners

So far we have investigated focus effects in the scope and the restrictor of nominal quantificational determiners. There are also determiners that appear to be sensitive to the focus within them. Krifka 1999 discusses cases with comparative quantifiers as (49).

(49) a. *More than THREE_F boys left.*
   b. *Less than THREE_F boys left.*

Classical General Quantifier analysis did not distinguish between the determiners and *more than three* and *four,* representing them as $\lambda P'\lambda P[\#(P \cap P') > 3]$ and $\lambda P'\lambda P[\#(P \cap P') \geq 4]$, respectively. These are truth-functionally equivalent, hence semantically indistinguishable. The reason for the representation of numerals like *four* as expressing ≥ 4 is to account for the fact that *Four boys left* is true if more than four boys left; it is only by scalar implicature that this sentence gets the interpretation that exactly four boys left.

(49)(a) lacks the implicature that excludes that more than four boys left, a fact not expected in General Quantifier theory. Krifka proposes that the determiner head, *more*, binds the set of alternatives introduced by focus, making them unavailable for scalar implicature. This is implemented in a theory in which the numeral *three* does not form part of the determiner, but is a numeral adjective that applies to sum individuals consisting of three atomic individuals. This provides the correct results for sentences with more

than one quantifier, as in *More than four girls kissed more than seven boys* (in the cumulative reading), and it is extended to quantifiers headed by *less* or *fewer* as in (49)(b).

Krifka 1999 applies a similar analysis also for quantifiers headed by *at least* and *at most*. Newer work has pointed out that these **superlative** are different in important respect. Geurts & Nouwen 2007 have argued that they are of a modal nature, and Cohen & Krifka 2011 proposed that they represent quantifications over speech acts. In any case, they also are sensitive to focus, just like comparative quantifiers.

The focus of *more than* can be broader than the numeral, as in (50).

(50)   *I ate more than* [*three APPLES*]$_F$ − *I also ate two pears.*

Another case of a determiner that appears to be inherently focusing is German *lauter*, which is derived from the adjective meaning 'pure' (cf. Eckardt 2002).

(51)   *In dem Kasten waren lauter Perlen.*
       in the box were LAUTER pearls
       'In the box there were only pearls, and a lot of them.'

In contrast to *only* (or German *nur*), *lauter* is a proper determiner that attaches to nominal expressions (mass and count), but not to names or to other constituents.

13.4 Information Structure on Determiners and Quantifiers

The cases discussed so far involved the interaction of determiners and quantifiers and expressions with a special information status, especially focused and given items. We now consider determiners and quantifiers that are themselves focused and/or given.

13.4.1   Focus on Determiners

In (52), the determiner is in focus, and the quantifier is a contrastive topic:

(52)   [[*SOME*$_F$] *cooks*]$_{Top}$ *were* [*HIRED*$_F$]

Here, *some* carries a rising accent, which is often considered to be a special marking for contrastive topics (cf. Chapter 3); here it is understood as indicating alternative topics. As usual, focus indicates alternatives, the alternatives being other quantifiers. The alternatives to *some*, naturally, are other quantifiers such as *all, most,* or *no*. These alternatives are used for the computation of scalar implicatures: If there is an alternative α that leads to a sentence that entails the one that is uttered, but not vice versa, then the sentence with this alternative is implicated to be false. In (52), the sentence *All cooks were hired* implicates *Some cooks were hired*, but not the other way round (things are less clear with *most*). Hence, (52) implicates that not all cooks were hired.

The relevant alternatives in the case of (52) are sentences in which the quantified DP is a topic – e.g., [*all cooks*]$_{Top}$ *were hired*, [*most cooks*]$_{Top}$ *were hired*, etc. This suggests a context question like *What happened to the cooks? Were they hired or fired?* This context question requires that there is a given set of cooks that the discourse is about. As a consequence, this forces a partitive reading of *some cooks*, a phenomenon observed and explained in this way in Büring 1996. A partitive (or strong) reading of a quantificational DP is one in which the nominal part is given in the context; it can generally be expressed with a partitive construction such as *some of the cooks*. However, the partitive

reading does not hinge on the topichood of *some cooks*. (53) also has a partitive reading without a topical interpretation of *some cooks*, as a context question like the one indicated is enforced.

(53) [A: *Were the cooks hired?*] B: [SOME]F *cooks were hired*.

Again, a salient alternative is *All cooks were hired.* Hence, a partitive reading of a quantifier is enforced if there is a focused-induced alternative that is itself partitive. If the focus-induced alternatives are not easily construed as partitive, as with number words, then focus does not lead to a partitive reading:

(54) [A: *How many cooks were hired?*] [THREE]F *cooks were hired.*

While the numeral *three* can be used in partitive constructions – as in *three of the cooks were fired* – focus on *three* as in (54) does not invoke other partitive quantifiers as alternatives. This also shows up in the following pattern of implicature cancellation:

(55) a. SOME *cooks have been fired, perhaps* ALL / MOST / FOUR *cooks*
     b. THREE *cooks have been fired, perhaps* *ALL / *MOST / FOUR *cooks*.

Hence focus data show that there are at two classes of quantification determiners, those that are naturally interpreted as partitive, and those that are not so interpreted.

13.4.2 Topical and Focused Quantifiers

A quantified DP can be in focus, as in the following case:

(56) A: *What did the students have to memorize*?
     B: *The students had to memorize* [*every chemical* ELEMENT]F.

As a consequence, the relation between quantifiers and topicality is certainly less strict than suggested in section 13.1. It is conceivable that quantifiers start out with restrictors that are topics, but then, as DPs, are subjected to general syntactic rules, and as a result occur in other DP positions as well. We would perhaps predict that quantifiers occur first in topic positions in language acquisition, and that quantifiers occur more frequently in topic positions – but this is still unknown.

The information structure status of quantifiers influences their **scope**. Sæbø 1997 observes that topical quantifiers have wide scope over focused quantifiers.

(57) a. A: *What did the candidates attend?*
        B: [*Several candidates*]Top *attended* [*every* MEETING]F.
           'For several candidates it holds that they attended every meeting.'

     b. A: *Who attended the meetings?*
        B: [*Several* CANDIDATES]F *attended* [*every meeting*]Top.
           'For every meeting it holds that several candidates attended it.'

Krifka 2001b argues that topical quantifiers can even scope over speech acts.

(58) a. *What did* [*every guest*]Top *bring to the party?*
     b. *What did* [EVERY]F *guest bring to the party?*

While *every guest* in (58)(a) can scope over the wh-constituent, leading to a quantification into a question ('For every guest x, what did x bring to the party?'), this is not available in (b) ('For which y does it hold that every guest brought y?').

The scopal behavior can be captured structurally within a framework that assumes that topics occupy syntactic positions that c-command foci, as in the "cartographic" theory of Rizzi 1997. For quantificational phenomena, such phenomena have been treated by Szabocsi 1997, who identifies three pre-verbal positions in Hungarian that differ in their information-structural potential, and can be occupied by different quantificational expressions. The outermost position is reserved for referential DPs, but can also be accessed by quantifiers headed by *a legtöbb* 'most'. The next position is taken by distributive quantifiers, e.g. DPs headed by *minden* 'every', and the immediate preverbal position is accessible to "counting" quantifiers headed by e.g *kevés* 'few' or *hatnál több* 'more than six'. Sometimes, one and the same DP can occur in distinct positions, leading to distinct interpretations (e.g., 'Mary saw two movies, namely X and Y' vs. 'The number of movies Mary saw was two').

Ebert 2009 performs similar tests with German, using an observation by Frey 2004 that only topics can occur within the German middle field in front of certain sentence adverbials. Consider the following example:

(59) *Während des Vortrags hat/haben* D *Student(en) interessanterweise geschlafen*.
    during   the talk   AUX.3S/3P D student(s)   interestingly   slept
    'During the talk, interestingly, X students slept'

In the position of D, determiners like *ein* 'a', *zwei* 'two', *einige* 'several', *viele* 'many', *die meisten* 'most' and perhaps also *jeder* 'every' are fine, whereas determiners like *kein* 'no', *wenige* 'few', *weniger als drei* 'less than three' or *höchstens drei* 'at most three' are bad. Quantifiers like *mehr als drei* 'more than three', *genau drei* 'exactly three', *fast jeder* 'nearly every' or *mehr als die Hälfte der* 'more than half of the' are degraded in the D position.

The first group of quantifiers can be understood as topical, in contrast to the second . The generalization, following Szabolcsi 1997, is that **monotone decreasing** quantifiers are definitely excluded from the topic position. These are quantifiers like *no student, few students* and *less than three students* for which it holds that if D(α)(β) holds, and β' applies to a subset of β, then D(α)(β') holds as well – for example, if *no student slept*, is true, then *no student slept and snored* is true. Why should this be so? Szabolcsi 1997 invokes the notion of a **minimal witness set**. A witness set for a quantifier Q is a set W such that Q(β) holds if and only if Q($\beta \cap W$) holds. For example, for *every student* the minimal witness set is the set of all students, and for *three students* a minimal witness set is any set that consists of three students. Now, a statement with a topical quantifier can be rephrased as being **about** such a minimal witness set of the quantifier: [[*D students*] *left*] is interpreted as: There is a minimal witness set W of [*D students*], and W left. Szabolcsi notes that for monotone decreasing quantifiers like *fewer than three students* the minimal witness set is empty, and hence this paraphrase does not work. We can modify Szabolcsi's criterion by talking about witness sets in general, and notice that the truth conditions of sentences of the form [[D NP] VP] with quantifiers [D NP] that are not upward monotone cannot be rephrased as statements about their witness sets.

Ebert 2009 suggests that topical quantifiers have the additional property that rephrasing them as statements about their witness sets does not change their anaphoric potential. This applies to quantifiers like *three students*, and distinguishes them from quantifiers like *every student*. The latter quantifier introduces discourse referents with a life span

limited to the sentence in which it occurs, whereas its reformulation in terms of statements on minimal witness sets involves discourse referents with unlimited life span.

Topicality has also been invoked to explain the discourse effects of **indefinites.** Cresti 1995, as well as Ebert 2009, have suggested that the wide-scope effects of specific indefinites come about as a result of their topicality.

13.5 Conclusion

It was the goal of this article to present the many ways in which quantification interacts with the information-structural features like focus, givenness and topic. I have argued that there is a fundamental connection, insofar as the restrictor of a quantifier can be understood as given. This fact relates to natural-language quantifiers being conservative.

There are different ways how the restrictor can be determined. With adverbial quantifiers, or A-quantification, it is particularly obvious that information-structural features play a major role, be it focus, givenness, or topicality expressed by prosody, syntactic movement, or morphological markings. With nominal quantification, or D-quantification, the restrictor is more rigidly defined by syntactic structure, as the NP complement of the determiner. However, we have seen a variety of exceptions to this rule with the determiners *many / few*, with proportional determiners, and with focusing determiners, where D-quantification is subject to similar rules as A-quantification. We furthermore have observed that the topichood or focusation of quantifiers themselves can affect their scope, and other aspects of their interpretation.

References

Bach, Emmon et al. (eds). 1995. *Quantification in natural lanugage*. Dordrecht: Kluwer Academic Publishers.

Barwise, Jon & Robin Cooper. 1981. Generalized quantifiers and natural language. *Linguistics and Philosophy* 4: 159-219.

Beaver, David I. & Brady Z. Clark. 2008a. *Sense and sensitivity. How focus determines meaning*. Malden, M.A. and Oxford: Wiley-Blackwell.

Beaver, David I. & Brady Z. Clark. 2008b. *Sense and sensitivity. How focus determines meaning*. West Sussex: Wiley-Blackwell.

Berman, Stephen. 1987. Situation-based semantics for adverbs of quantification. In: Blevins, J. & A. Vainikka, (eds), *University of Massachusetts Occasional Papers 12*. Amherst: University of Massachusetts,

Berman, Stephen. 1989. An analysis of quantificational variability in indirect questions. In: Bach, Emmon, Angelika Kratzer & Barbara Partee, (eds), *Papers on Quantification*. Department of Linguistics, University of Massachusetts at Amherst,

Büring, Daniel. 1996. A weak theory of strong readings. *Proceedings of SALT VI*. 1996. 17-34.

Carlson, Greg N. 1989. The semantic composition of English generic sentences. In: Chierchia, Gennaro, Barbara Partee & Raymond Turner, (eds), *Properties, types and meaning*. Kluwer, 167-192.

Chafe, Wallace L. 1976. Givenness, contrastiveness, definiteness, subjects, topics and point of view. In: Li, Charles N., (ed), *Subject and Topic*. New York: Academic Press, 27-55.

Chierchia, Gennaro. 1995. *Dynamics of meaning. Anaphora, presupposition, and the theory of grammar.* Chicago: University of Chicago Press.

Cohen, Ariel. 1999. How are alternatives computed? *Journal of Semantics* 16: 43-65.

Cohen, Ariel. 2001. Relative readings of many, often and generics. *Natural Language Semantics* 9: 41-67.

Cohen, Ariel & Nomi Erteschik-Shir. 2002. Topic, focus, and the interpretation of bare plurals. *Natural Language Semantics* 10: 125-165.

Cohen, Ariel & Manfred Krifka. 2011. Superlative quantifiers as modifiers of meta-speech acts. *The Baltic International Yearbook of Cognition, Logic and Communication* 6: 1-56.

Cresti, Diana. 1995. *Indefinite topics*. Doctoral Dissertaiton, Cambridge, Mass.: MIT.

de Hoop, Helen & J. Solà. 1996. Determiners, context sets, and focus. *WCCFL*. 14. 155-167.

Diesing, Molly. 1992. Bare plural subjects and the derivation of logical representations. *Linguistic Inquiry* 23: 353-380.

Eckardt, Regine. 1999. Focus with nominal quantifiers. In: Bosch, Peter & Rob van der Sandt, (eds), *Focus. Linguistic, cognitive and computational perspectives*. Cambridge: Cambridge University Press, 166-186.

Eckardt, Regine. 2002. Semantic change in grammaticalization. In: Graham Katz (ed.), *Proceeding of Sinn und Bedeutung* 6. Osnabrück.

Elbourne, Paul. 2005. *Situations and individuals.* Cambridge, Mass.: MIT Press.

Ebert, Cornelia. 2009. *Quantificational topics: A scopal treatment of exceptional wide scope phenomena*. Springer.

Frey, Werner. 2004. A medial topic position for German. *Linguistische Berichte* 198: 153-190.

Geilfuß-Wolfgang, Joachim. 1995. *Über gewisse Fälle von Assoziation mit Fokus.* Tübingen: Universität Tübingen.

Geurts, Bart & Rick Nouwen. 2007. 'At least' et al.: The semantics of scalar modifiers. *Language* 83: 533-559.

Halliday, M. A. K. 1970. *A course in spoken English: Intonation.* Oxford: Oxford University Press.

Heim, Irene. 1982. *The semantics of definite and indefinite noun phrases.* University of Massachusetts at Amherst.

Heim, Irene. 1990. E-type pronouns and donkey anaphora. *Linguistics and Philosophy* 13: 137-177.

Herburger, Elena. 1993. Focus and the LF of NP quantification. In: Lahiri, Uptal & Adam Zachary Wyner, (eds), *SALT III*. Ithaca: Cornell University, Department of Modern Languages and Linguistics, 77-96.

Herburger, Elena. 1997. Focus and weak noun phrases. *Natural Language Semantics* 5: 53-78.

Hinterwimmer, Stefan & David Schueler. 2012. Requantification and partial focus in indefinites. *Sinn und Bedeutung*. 16. Cambridge, Mass.: MITWPL,

Kadmon, Nirit. 1987. *On unique and non-unique reference and asymmetric quantification.* Doctoral dissertation. University of Massachusetts at Amherst.

Kamp, Hans. 1981. A theory of truth and semantic representation. In: Groenendijk, J.A.G., T.M.V. Janssen & M.B.J. Stokhof, (eds), *Formal Methods in the Study of Language*. Amsterdam: Mathematical Centre Tracts 135, 277-322.

Kasper, Walter. 1987. *Semantik des Konjunktivs II in Deklarativsaetzen des Deutschen*. Tübingen: Niemeyer.

Keenan, Edward L. & Jonathan Stavi. 1986. A semantic characterization of natural language determiners. *Linguistics and Philosophy* 9: 253-326.

Keenan, Edward L. 2003. The definiteness effect: Semantics or Pragmatics? *Natural Language Semantics* 11: 187-216.

Keenan, Edward. 2011. Quantifiers. In: Maienborn, Claudia, Klaus von Heusinger & Paul Portner, (eds), *Semantics: An international handbook of natural language and meaning*. Berlin: Mouton de Gruyter.

Keenan, Edward L. & Denis Paperno (eds). 2012. Handbook of quantifiers in natural language. *Studies in Linguistics and Philosophy* 90, Springer.

Kratzer, Angelika. 1991. Conditionals. In: von Stechow, Arnim; Wunderlich, Dieter, (ed), *Semantik: ein internationales Handbuch der zeitgenössischen Forschung / Semantics: An international handbook of contemporary research*. Berlin: Walter de Gruyter, 651-656.

Krifka, Manfred. 1990. Four thousand ships passed through the lock: object-induced measure functions on events. *Linguistics and Philosophy* 13: 487-520.

Krifka, Manfred et al. 1995. Genericity: an introduction. In: Carlson, Greg N. & F. J. Pelletier, (eds), *The generic book*. Chicago, London: The University of Chicago Press, 1-124.

Krifka, Manfred. 1995. Focus and the interpretation of generic sentences. In: Carlson, Gregory N. & Francis Jeffry Pelletier, (eds), *The Generic Book*. Chicago: Chicago University Press, 238-264.

Krifka, Manfred. 1999. At least some determiners aren't determiners. In: Turner, Ken, (ed), *The semantics/pragmatics interface from different points of views*. Oxford / Amsterdam: Elsevier, 257-291.

Krifka, Manfred. 2001a. Non-novel indefinites in adverbial quantification. In: Condoravdi, Cleo & Gerard Renardel der Lavalette, (eds), *Logical perspectives on language and information*. Stanford: CSLI Press, 1-40.

Krifka, Manfred. 2001b. Quantifying into question acts. *Natural Language Semantics* 9: 1-40.

Lappin, Shalom. 1988. The semantics of 'many' as a weak determiner. *Linguistics* 26: 977-998.

Lewis, David. 1975. Adverbs of quantification. In: Keenan, E.L., (ed), *Formal semantics of natural languages*. Cambridge: Cambridge University Press, 3-15.

Matthewson, Lisa (ed). 2008. *Quantification. A cross-linguistic perspective*. Bingley: Emerald.

Milsark, Gary. 1974. *Existential sentences in English*. Cambridge, Mass.: MIT.

Park, Yugyeong. 2007. *A study on the semantic characteristics of the proportional quantifier floating in Korean*. Master's thesis. Seoul: Seoul National University.

Partee, Barbara. 1999. Focus, quantification and the semantics-pragmatics issue. In: Bosch, Peter & Rob van der Sandt, (eds), *Focus. Linguistic, cognitive and computational perspectives*. Cambridge: Cambridge University Press, 213-231.

Partee, Barbara H. 1991. Topic, focus and quantification. *Proceedings from Semantics and Linguistic Theory 1, Cornell Working Papers in Linguistics*. Cornell: 159-188.

Reinhart, Tanya. 1986. Center and periphery in the grammar of anaphora. In: Lust, Barbara, (ed), *Studies in the acquisition of anaphora*. Dordrecht: Reidel,

Rizzi, Luigi. 1997. The fine structure of the left periphery. In: Haegeman, Liliane, (ed), *Elements of grammar*. Dordrecht: Kluwer, 281-337.

Rooth, Mats. 1985. *Association with focus.* University of Massachusetts at Amherst.

Rooth, Mats. 1995. Indefinites, adverbs of quantification and focus semantics. In: Carlson, Gregory N. & Francis Jeffry Pelletier, (eds), *The Generic Book*. Chicago: Chicago University Press, 265-291.

Rooth, Mats. 1999. Association with focus or association with presupposition? In: Bosch, Peter & Rob van der Sandt, (eds), *Focus. Linguistic, cognitive and computational perspectives*. Cambridge: Cambridge University Press, 232-246.

Sæbø, Kjell-Johan. 1997. Topic, focus and quantifier raising. In: Dekker, Paul, Martin Stokhof & Yde Venema, (eds), *Proceedings of the Eleventh Amsterdam Colloquium*. ILLC/Department of Philosophy, University of Amsterdam, 67-72.

Sauerland, Uli. 2014. Surface non-conservativity in German. *Empirical Issues in Syntax and Semantics* 8. 125-142.

Schubert, Lenhart K. & Francis J. Pelletier. 1987. Problems in the representation of the Logical Form of generics, bare plurals, and mass terms. In: LePore, E., (ed), *New Directions in Semantics*. New York: Academic Press.

Schwarzschild, Roger. 1999. GIVENness, AvoidF and other constraints on the placement of accent. *Natural Language Semantics* 7: 141-177.

Sgall, Petr, Eva Hajicova & J. Panenova. 1987. *The meaning of the sentence and its semantic and pragmatic aspects.* Dordrecht: Reidel.

Solt, Stephanie. 2009. *The semantics of adjectives of quantity.* Doctoral dissertation. New York: City University of New York.

Szabolcsi, Anna. 1997. Strategies for scope taking. In: Szabolcsi, Anna, (ed), *Ways of scope taking*. Dordrecht: Kluwer, 109-154.

Szabolcsi, Anna. 2010. *Quantification.* Cambridge Universitiy Press.

von Fintel, Kai. 1994. *Restrictions on quantifier domains.* Ph.D. Amherst, MA: University of Massachusetts at Amherst.

Westerståhl, Dag. 1985. Logical constants in quantifier languages. *Linguistics and Philosophy* 8: 387-413.