Syntactic and semantic theories of quantificational phenomena traditionally treat all noun phrases alike, thus predicting that noun phrases exhibit a uniform behavior. It is well-known that this is an idealization: in any given case, some noun phrases will support a desired reading more readily than others. Anyone who has lectured on quantifier scope ambiguities to a class of unbrainwashed undergraduates will recall the amount of preparation time that goes into coming up with two or three examples that the class will judge to be ambiguous in exactly the ways the theory under discussion predicts. The same experience with "good citizens" and "bad citizens" repeats itself in connection with branching, anaphora, distributive versus collective readings, extraction, event quantification, pair-list questions, and so on.

Is the assumption of uniformity a theoretically necessary idealization, then, or is it an overgeneralization based on a small body of initial data? There is no doubt that, to some extent, it is a necessary idealization. To what extent it is, though, depends on how systematic the patterns of deviation turn out to be, and how coherent and interesting theoretical accounts can be devised for those patterns.

The unique contribution of this volume consists in scrutinizing large bodies of data, both well-known and novel, from a theoretical perspective and arguing that the patterns emerging are systematic and significant enough to prompt rather fundamental revisions of the standard accounts.

In proposing alternatives, many of the papers follow a heuristic that may be summarized as follows: The range of quantifiers that participate in a given process is suggestive of exactly what that process consists in. Instead of devising omnivorous rules that apply to all quantifiers and then need to be constrained in various, sometimes ad hoc, ways, it is proposed that the grammar of quantification involves a variety of distinct, often semantically conditioned, processes. Each type of expression participates in those processes that suit its particular properties. The main specific claims are to be reviewed shortly.

There are important results in recent semantic and syntactic literature that point in a similar direction. On the semantics side, the empirical theories of discourse representations and plurals have pointed out important respects in which different noun phrase types contribute differently to interpretation, and the mathematical theories of generalized quantifiers and partially ordered sets offer tools for making various distinctions that may prove empirically relevant. On the syntax side, the minimalist program postulates that movement is not input-blind and optional, but it is driven strictly by the specific properties of lexical items, as in a number of other lexicalist approaches.

The work reported here pulls many of these results together and applies their insights in a unified manner.

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The issues addressed in the volume fall into two major categories, (i) the syntax/semantics interface and (ii) more or less pure semantics. Syntax is relevant also in the second category: in some cases a semantic account is offered for a phenomenon usually held to
be syntactic, or vice versa.

Many papers in the volume make use of some simple tools of formal semantics. Often, their empirical predictions derive directly from formal semantic considerations. To make these arguments more accessible and, hopefully, pleasurable to the reader, the first chapter offers a fairly informal introduction to the pertinent background notions in lattice theory and generalized quantifiers.

The first set of papers pertains to the syntax/semantics interface. They focus on data where the missing readings are, in and of themselves, as coherent as the available ones; the problem is that the grammar of English does not associate them with the given strings of words. The central issue in these papers is how different noun phrase types acquire their scope and, consequently, how they interact with each other and with negation.

Traditionally, syntactic and semantic theories have assumed that all noun phrases are assigned scope by the same rule, that the scope assignment rule is optional, that it can \"prefix\" the quantifier to practically any syntactic domain, and that wide scope equals distributive wide scope. In a series of papers, Beghelli and Stowell have challenged these assumptions and developed a novel approach to Logical Form. The motivation for the proposed changes is empirical. As is shown by Kroch's, Ioup's, and Liu's work as well as more recent research including Beghelli and Stowell's own, quantifier types differ in important respects.

Consider a small sample of the contrasts. More than three men and every man differ in their readiness to take inverse scope: More than three men read every book easily admits the interpretation \`For every book, there are more than three men who read it,' but not so for Every man read more than three books \`There are more than three books which every man read.'

Numerical indefinites and universals can both take inverse scope as far as existential import is concerned, but differ in supporting inverse distributive readings: compare More than three men read every book above, which allows the men to vary with the books, with More than three men read two of the books, which does not, although the two books can be picked independently of the men. More than one man and every man differ with respect to their interaction with negation: More than two men didn't laugh is a fine sentence, but Every man didn't laugh, with a non-contrastive intonation, is not; I didn't read more than two books is ambiguous, but I didn't read every book admits only a \`not every' interpretation.

The contents of the volume offer an account of these and similar contrasts in terms of minimalist theory of Logical Form, whose distinctions can be correlated with those of Discourse Representation Theory and to some extent motivated by generalized quantifier theoretic considerations.

Formulated within the minimalist program of syntax, Beghelli and Stowell make the following basic assumptions. (a) Noun phrases acquire their scope as a by-product of moving into syntactic positions where they can check some scope-independent morphological and/or semantic feature, and (b) Distributivity is effected by a syntactically separate operator. These assumptions are useful in the following way.

Since noun phrases differ in morphological and semantic properties, (a) yields an account of the diversity of their behavior. To be more specific, B&S claim that the target landing sites of noun phrases include, along with the specifier positions of well-known categories like CP, NegP
and Case/AgrP, those of a novel set of functional projections, RefP, DistP, and ShareP. Plurals like (the) two men move to the specifier of RefP or ShareP, and distributive universals like every man to DistP. Modified numerals like more/less than three men do not move above their case positions and thus scope in situ.

As regards (b), B&S argue that both plurals and universals are associated with a set-denoting part and a phonetically null distributive operator. The distributive operator associated with plurals is the silent each known from the semantics literature; syntactically, it is shown to have the properties of floated each, an adverbial element that attaches to some heads, but not to others. On the other hand, the distributive operator associated with universals (and other noun phrases that pattern with them) is syntactically the head of DistP.

![Diagram of DistP structure]

The fact that distributivity is factored out and represented in these particular syntactic ways allows the theory to account for a variety of subtle phenomena, including the separability of the existential important and the distributivity of noun phrases, the clause-boundedness of distributivity, the differential ability of noun phrases to induce referential variation when taking inverse scope, and the deviations from the basic patterns in interaction with negation and wh-phrases.

The outlines of the general theory and the interaction of universals with other quantifiers and negation are laid out in Beghelli and Stowell's Distributivity and negation in this volume. Beghelli's The syntax of distributivity and pair-list readings introduces the two types of distributivity in detail and applies the results to uncover and explain new data, along with the notorious syntactic asymmetries, in connection with wh/QP interactions. More on this paper below.

The one feature of B&S's scope syntax that may appear strikingly baroque is the postulation of a multitude of new LF landing sites. Strategies for scope taking by Szabolcsi offers independent motivation for this feature. It is shown that the surface syntactic scope positions that have for long been postulated for noun phrases in Hungarian correspond to the positions B&S posit for Logical Form in English.

Szabolcsi's paper further addresses the relation between B&S's scope theory and Discourse Representation Theory. On the basis of their commonalities as well as the syntactic advantages of B&S's proposal, it is proposed that B&S's way of constructing Logical Forms should, essentially, replace Kamp and Reyle's DRS construction algorithm. Concretely, movement into RefP and DistP correspond to introducing discourse referents, while noun phrases that scope in their case positions are interpreted as performing a counting operation on predicates. Hungarian data play a crucial role in substantiating some of these claims. The upshot
is that the independent structure that B&S demonstrate scope lives off of is, in semantic terms, a kind of discourse representation structure.

In Computing quantifier scope, Stabler offers a different perspective on the issue of how semantic properties of noun phrases may affect their scopal syntactic abilities. Noting that the same properties manifest themselves in the inferential behavior of noun phrases, which can be represented syntactically, he proposes to reverse the order of explanation. He does not assume that the speaker has some grasp of the semantic value of the expression first and then decides where to put it in syntactic structure. Instead, the speaker uses the expression in a certain way, in the syntax according to the requirements specified in its features, and in inference. The proposal is implemented within a novel formalization of minimalist syntax, applied to B&S’s theory.

Semantic groundwork for Beghelli and Stowell’s as well as Szabolcsi’s papers is laid Beghelli, Ben-Shalom and Szabolcsi in Variation, distributivity, and the illusion of branching. The paper demonstrates the need to factor scope into referential variation, distributivity, and maximality, and goes on to show that increasing (upward entailing) QPs can take scope in ways that are precluded for non-increasing QPs, due to the maximality condition associated with the latter. In this way, a basic characterization is offered for the the two larger types of QPs and their respective ways of scope taking. QPs that move to RefP, DistP, or ShareP and introduce discourse referents are all increasing; QPs that do not move above their Case positions and do not introduce discourse referents have all the non-increasing ones among them.

The paper applies the same conceptual apparatus to the study of branching readings, whose descriptive constraints have been observed by Liu. It is argued that (in the set of data considered) no specific branching quantifier needs to be, or indeed, should be, postulated in English. All the empirically attested branching readings are logically equivalent to another reading that needs to be derived anyway: a scopally asymmetrical or a cumulative one.

Whatever their take on the role of semantics, all the papers above assume that scope is a structural notion. Farkas, whose 1981 CLS paper contains some of the classical observations concerning the scope and distributivity of indefinites, proposes a non-structural approach. In Evaluation indices and scope, the relative scope of two expressions is a matter of possible dependencies of indices, seen as Kaplan-style coordinates of evaluation. In this way, Farkas’s approach may be closer in spirit to Groenendijk and Stokhof style Dynamic Semantics than to Kamp and Reyle style DRT. This paper goes beyond the others in empirical coverage: it examines, in addition to noun phrases, the discourse scope of conditionals, modal and intensional expressions.

* The above considerations pertain to the syntax/semantics interface. The second set of papers argues that scope assignment can go wrong in a directly semantic way as well, namely, the intended meaning may be incoherent and, therefore, “unthinkable.”

Such incoherence is the source of the ungrammaticality of How much milk didn't you drink?, in distinction to the well-formedness of Which books didn't you read?, argue Szabolcsi and Zwarts in Weak islands and an algebraic semantics for scope taking. The impossibility of how-extraction out of a negative island is assimilated to that of the combination of a numeral with a mass noun, as in six airs. In both cases, the explanation is that the interpretation of the construction requires us to perform an operation (complement formation in the first case,
counting in the second) on a semantic structure that does not lend itself to that operation.

The paper explicates a denotational semantic limitation on scope interaction using some simple notions of lattice theory. The nature of the argument can be best illustrated by way of an example. Overt wh-extraction creates a syntactic configuration with an extraction domain D containing a gap $\alpha$. Let D contain another scopal element $\beta$, which the filler of the gap is supposed to scope over.

\[
\text{[how much milk]} \, [D \, \text{did} \, [\beta \, \text{n't you drink}] \, [\alpha \, \text{--}]]
\]
\[
\text{[which books]} \, [D \, \text{did} \, [\beta \, \text{n't you read}] \, [\alpha \, \text{--}]]
\]

To calculate the denotation of the whole sentence, the denotation of D needs to be calculated. The question is whether this is possible, in view of what $\alpha$ and $\beta$ are.

The kind of denotation D has is, to a large extent, determined by what kind of gap it contains. For instance, did you read [gap of which books] denotes a set of individuals. But did you drink [gap of how much milk] arguably does not; Sz&Z argue it denotes an amount. Now, the general claim is that the narrow scope element $\beta$ is interpreted by cashing out its contribution in terms of some operation(s) over the denotation of D minus $\beta$. For instance, n't in the examples above requires us to take the complement of that denotation. Sets of individuals form Boolean algebras, in which complement formation is defined, thus didn't you read [gap of which books] is perfectly coherent. Amounts, on the other hand, form join semi-lattices at best, in which complement formation is not defined. Hence, the denotation of didn't you drink [gap of how much milk] cannot be calculated. In general, this kind of conflict arises whenever the interpretation of $\beta$ involves at least one Boolean operation not available in the structure that the denotation of D minus $\beta$ belongs to.

The unacceptable extraction of amount and manner expressions out of negative islands, wh-islands, and factive islands is called a "weak island violation." Weak islands were traditionally thought to belong to the realm of pure syntax. More recently, it has been argued that they are due to the inability of the given wh-phrase to take scope over some other scopal element in the extraction domain. Sz&Z concur with this view; the novel feature of the paper is the above reviewed algebraic semantic characterization of scope interaction, which explains why some expressions are unable to scope over certain others.

Naturally, the same considerations apply to covert scope assignment, in addition to the considerations discussed in the first set of papers.

The same semantic explanation extends, according to Honcoop and Doetjes, to the fact that event-related readings are sensitive to weak islands. The semantics of event-related readings: a case for pair-quantification proposes to treat the numeral in Krifka's famous Four thousand ships passed through the lock as quantifying over <event,object> pairs. Events are standardly thought to have a join semi-lattice structure without a bottom element, and <event,object> pairs inherit this from their event component. Thus Four thousand ships didn't pass through the lock has no event-related reading.

The pair-quantificational approach is argued to explain empirical constraints on event-related readings that go well beyond sensitivity to weak islands. Both the restriction and the scope of the pair-quantifier need to contain both an event and an object variable. Symmetric (weak) determiners (like four thousand) support event-related readings without further ado, because symmetry allows the copying of the verbal predicate that supplies the event variable into
the determiner's restriction, by plain inference. Non-symmetric (strong) determiners support an event-related reading only when an event variable occurs in the restriction either due to ``rebracketing'' induced by focus (Most ships passed through the lock YESTERDAY) or because the noun is modified by a relative clause (Most ships that passed through the lock transported radio-active waste). The specific treatment of the event variable is cast in terms of dynamic semantics, and parallelisms with donkey anaphora are explored.

Two papers in the volume are concerned with the phenomenon of pair-list readings. In addition to their interest as a further type of scope interaction, pair-list readings are directly relevant in connection with the scopal account of weak islands. There are two ways in which a scopal intervener \( \beta \) may turn out to be harmless. One, the interpretation of \( \beta \) may only involve operations that the relevant structure is closed under. Two, \( \beta \) may support an alternative wide scope reading, and thus ``get out of the way.''

Such is the case with the intervening universal in How much milk did every kid drink?. This question is bad when every kid takes narrow scope, but good when it supports a pair-list reading.

Both papers on wh/QP interactions begin by showing that the actual distribution of pair-list readings is so different from what is assumed in the literature that it causes the standard syntactic and semantic accounts to lose much of their force.

Based on what QPs support a pair-list reading in what context, in Quantifiers in pair-list readings Szabolcsi shows that two quite different types need to be distinguished. Pair-list readings in matrix questions and in complements of wonder-type verbs are induced only by universals and can be assimilated to multiple interrogation. On the other hand, almost any QP induces a pair-list reading in complements of find out-type verbs; crucially, even non-increasing ones do. Compare Where do fewer than five suspects live? with We only found out where fewer than five suspects live. The standard analyses, according to which the quantifier in a pair-list reading contributes a set to restrict the domain of the question would work for all and only upward monotonic quantifiers in both contexts (too many for the first, too few for the second). It is argued that pair-list readings in find out-complements must be treated as quantificational. In the context of the present volume, this means that each QP supports a pair-list reading in the same fashion as it takes scope in other, non-wh contexts.

The syntax of distributivity and pair-list readings by Beghelli is an integral part of the theory of Logical Form that was reviewed in the first part of this introduction. As was mentioned, the theory distinguishes two types of distributivity: that induced by the Dist head associated with universals (called strong distributivity), and that induced by the covert counterpart of floated each associated with plurals (pseudo-distributivity). Among other things, the two types differ in what interactions they make possible between a subject and a complement on the one hand, and between two complements on the other. E.g. Five of these students read every/two book(s) 'for every book / *for each member of set of two books, there is a possibly different set of five of these students who read it' and John showed every book / five of these books to a student 'for every book / ?for each of these five books, John showed it to a possibly different student.'

The paper lays out the general properties of the two types of distributivity and goes on to apply them in the study of pair-list readings. It is well-known that some pair-list readings exhibit robust syntactic asymmetries: good What did everyone read? contrasts with bad Who read everything?. These have been accounted for in the literature in terms the Empty Category Principle and Weak Cross-over, for instance. Beghelli makes the surprising observation that a larger sample of data reveals that the patterns do not match either the ECP or WCO. Instead, the
behavior of universals in find out-complements matches the pattern of strong distributivity; in matrix questions and in wonder-complements, it matches the pattern of pseudo-distributivity.

The syntactic analyses Beghelli develops on this basis of such observations square well with the semantic claims in the previous paper.

Several papers in the volume make use of the tools of the theory of generalized quantifiers in connection with standard noun phrases. In the literature, wh-phrases or questions do not fall under the scope of that theory. In Questions and generalized quantifiers, Gutiérrez-Rexach argues that it is both possible and insightful to bring them into the fold. He interprets questions as functions that assign the value true or false to answer sets. E.g., in a world where John and Mary walk, Who walks? assigns true to a set if it is identical to the set of walkers, i.e. \{j,m\}. This yields the same interpretation of questions as Groenendijk and Stokhof’s, but it is formulated in such a way that makes it possible to extend the apparatus of generalized quantifier theory to questions: notice that the wh-phrase relates two properties, the ones named by the question and by the answer set, as determiners do. The paper shows that the well-known properties of determiners carry over to wh-expressions. Finally, some cases of multiple interrogation, cumulative, and pair-list readings are shown to be irreducibly polyadic.

This concludes the summary of the main results in connection with scope at the syntax/semantics interface and in semantics.