Calculating the scope of negation. Interaction of negation with quantifiers.*

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Abstract: This chapter investigates scopal interactions between sentential negation and quantifiers, with special attention to the relative scope of negation and quantificational subjects. We examine a variety of proposals that explore the influences of phrase structure, focus, topic, and other pragmatic factors on the scope of negation. We also examine the related phenomena of incorporated negation in quantifiers and negative islands.

Keywords: negation, scope, quantification, focus, topic

"Whatever version of the grammar of negation is adopted, the analyst must eventually confront one of the most extensively studied and least-understood phenomena within the semantics of negation: the scope interaction of the negative operator with quantified subjects and with descriptions." (Horn 1989: 483)

16.1 Introduction

When an Amtrak train approaches a station with a short platform, passengers wishing to debark must walk forward to a car that meets the platform. The conductor's announcement to the passengers includes the statement in (1).

(1) All doors will not open.

U.S. coins come in denominations of 1 cent (penny), 5 cents (nickel), 10 cents (dime), and 25 cents (quarter). There is a children's riddle that goes as in (2).

(2) Q: You have two coins that add up to 30 cents. One of them is not a quarter. What are they?
A: A nickel and a quarter.

An August 2018 interview on "Meet the Press" contained the following exchange between the U.S. President's attorney (R. Giuliani) and the show's host (C. Todd):[1]

(3) GIULIANI: When you tell me that, you know, he should testify because he's going to tell the truth and he shouldn't worry, well that's so silly because it's somebody's version of the truth. Not the truth.

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[1] Source: https://www.politico.com/story/2018/08/19/giuliani-truth-todd-trump-788161

TODD: Truth is truth.
GIULIANI: No, no, it isn't truth. Truth isn't truth.

Examples (1) and (2) show what Carden (1970) calls the NEG-Q and NEG-V readings of negation, respectively. In (1) the passengers must (eventually) understand negation to take scope above the quantificational subject, *all doors*, yielding the negation of the proposition that all doors will open. In (2), to solve the riddle one must take the negation in *One of them is not a quarter* to fall within the scope of the subject; as the answer to the riddle confirms, one of the coins indeed is not a quarter. (The other one is.) Carden's terminology reflects the intuition that negation encompasses the quantifier in the one case (NEG-Q) but only the verb phrase in the other (NEG-V). Finally, as (3) shows, a NEG-Q-like reading is possible even with a non-quantificational subject. Giuliani here does not claim that truth is equivalent to non-truth; rather, he rejects Todd's tautological formulation, and by extension the notion that matters are quite so simple.

In this chapter we examine the scopal interactions between negation and quantifiers. We will focus in particular on the question of what causes a quantificational subject to be understood as falling within the scope of clausemate sentential negation and vice versa, i.e. on how to understand and account for the distribution of the NEG-Q and NEG-V readings. As Horn's quote above attests, this is a puzzle with a long history.

We begin by laying out some background assumptions about the syntax and semantics of scope-taking in section 16.2. In section 16.3, we examine a variety of recent proposals for how to account for the relative scope of negation and quantifiers. The accounts make appeal to phrase structure, focus, topic, and related pragmatic factors in order to explain why a particular environment might favor a particular scope relation. In section 16.4, we examine some related issues in the grammar of quantifiers and negation. Section 16.5 concludes.

16.2 Scope of negation and the grammar of scope-taking

Quantificational DPs and negation are both standardly analyzed as scope-bearing expressions. While there is a wide variety of approaches to the semantics of scope, for present purposes I will assume that a scope-bearing expression denotes a function that takes a sentence denotation as its argument. Negation is typically analyzed as the truth-functional operator familiar from propositional logic; it flips the truth value of its argument. Quantificational DPs are typically analyzed as generalized quantifiers over individuals (after Barwise and Cooper 1981); they compose with an open sentence or, in the more commonly adopted style of implementation, with a predicate formed via abstraction over the free variable in an open sentence (see, e.g., Heim and Kratzer 1998).

In the generative tradition, scope relations are represented at the syntactic level of logical form (LF). Sentential negation is generally taken to be syntactically immobile, while quantificational DPs undergo (often obligatory) covert movement from their base/θ-position to a scope position, in a process known as quantifier raising (QR). In the implementation of May (1985), LF

representations generated via QR do not necessarily disambiguate relative scope; more recent implementations, by contrast, generally take LF to encode scope relations unambiguously.

In English and many other languages, sentential negation sits both linearly and hierarchically between the positions of the subject and the object.[2] An LF that preserves this hierarchical order will thus be one in which the subject takes scope over negation, and negation takes scope over the object (provided there is an available scope position for the object below negation, as indeed there must be if negation operates on sentences). As (4a,b) show, quantificational objects tend to take scope below negation by default. The wide-scope reading for the object comes out more readily in (4c), where the most salient reading is *every* > *one* > *not*. (For more on the role played by the dependent indefinite in bringing out this reading, see the discussion of Beghelli and Stowell (1997) below in section 16.3.1.) Positive polarity items like *someone* resist being in the scope of negation in examples like (5a), where the only available reading is *some* > *not*. A narrow-scope reading is possible, however, in the presence of an appropriate higher operator, as in (5b) (Baker 1970, Szabolcsi 2004). As a general matter, then, objects are able to take scope both above and below sentential negation.

(4) a. John didn't read every book.
    b. John didn't tell everyone his secret.
    c. John didn't tell everyone one piece of information.
(5) a. John didn't tell someone his secret.
    b. It's a shame John didn't tell someone his secret.

Subjects are likewise able in principle to take scope both above and below sentential negation: these are the relative scope configurations that yield the NEG-V and NEG-Q readings, respectively. Unlike with objects, the phrase structure and syntactic derivation of subjects is usually taken to involve an interaction with the syntactic position of negation. Specifically, on many approaches the base/θ-position of the subject is within the (possibly extended; Kratzer 1996) projection of the verb, below negation, while its surface position is higher, in the tense projection above negation, where it moves for reasons of Case and/or EPP. The core syntax of subjects thus involves a movement/copying relationship that spans the position of negation, as sketched in (6).

(6) $[_{TP}$ John$_i$ did $[_{NegP}$ not $[_{vP}$ t_i read the book]]]

We thus find an asymmetry between subjects and objects with respect to their scope relations with negation. An LF where an object takes scope above negation will be one where QR has moved it higher than necessary purely for purposes of interpretation; if QR is governed by Shortest Move, then this will always be an optional instance of QR (Takahashi 2006). An LF where a subject takes scope below negation, by contrast, will be one where quantifier lowering

[2] Some languages make multiple positions available for negation. See Zanuttini (1997) for a study of negation in Romance.

has taken place; in copy-theoretic terms, it will be an LF where the lower copy in an A-chain (including the determiner) is interpreted. In other words, it will be an instance of scope reconstruction. (For discussion of scope reconstruction in A-chains, see Boeckx 2001; for discussion of Scope Economy and related constraints on optional QR, and their interaction with negation, see Fox 2000, Mayr and Spector 2012, and Fleisher 2015; for discussion of more general constraints on QR, see Cechetto 2004.)

The relative scope of subjects and negation has received the bulk of the attention in the literature, and it will be our major focus in the remainder of the chapter. As we will see, authors differ on a number of basic questions in this area; one such issue is whether the unavailability of a certain scope configuration is due to the grammar not generating the corresponding LF or to some other principle filtering it out. Scope of negation is thus an area where we see a broader set of theoretical questions being debated: how much semantic and pragmatic information is represented directly in (and thus constrained by) syntactic structure, and how much should be attributed to extrasyntactic factors?

16.3 Selected approaches

16.3.1 Scopal cartography

It has long been recognized that unconstrained QR overgenerates readings in sentences with multiple scope-takers. Beyond asymmetries in the availability of inverse scope for different combinations of subject and object quantifiers, we can classify quantifiers according to their interactions with different classes of scope-takers. Beghelli and Stowell (1997) develop a theory in which such constraints on relative scope receive not a semantic or a pragmatic explanation but a syntactic one, the result of an articulated clausal spine containing a variety of specialized functional heads. Constraints on scopal interactions between quantifiers and negation are, on this view, simply a special case of the more general limitations on scope-taking that follow from the exploded phrase structure of the clause.

In Beghelli and Stowell's system, quantifiers take scope not via ordinary QR but via feature-driven movement to the specifier of a functional head. The featural content of a given quantifier determines how high it may raise and thus where it may take scope: for some quantifiers, there is just a single functional head against which they may check their features, while other quantifiers have multiple options and a concomitant scopal mobility within the clause. Simplifying slightly, Beghelli and Stowell propose the following hierarchy of functional projections:

(7) Ref > C > Dist > Share > Neg > V

Distributive universal DPs like those headed by *each* and *every* raise to the specifier of DistP, a relatively high position just below C, while negative DPs and sentential negation sit in NegP, a relatively low position. This phrase structure for the clause, in combination with the operative assumptions about how quantifiers take scope, predicts NEG-V readings for sentences with

universally quantified subjects.[3] As Beghelli and Stowell note, however, with neutral intonation even the ordinary NEG-V reading seems awkward and difficult to access; this is shown in (8).[4]

(8) a. ?? Every boy didn't leave.
b. ?? Each boy didn't leave.

Beghelli and Stowell observe that the acceptability of such configurations is greatly improved when a counting indefinite occurs in object position, as in (9). The improvement, they note, is limited to the reading of such sentences in which the object scopes above negation, i.e. 'for each boy *x* there is one book *y* such that *x* didn't read *y*'.

(9) a. Every boy didn't read one book.
b. Each boy didn't read one book.

Beghelli and Stowell explain the contrast between (8) and (9) through appeal to the semantic needs of distributivity. The examples in (8) are awkward, they propose, because the distributive universal DP in SpecDistP lacks a distributed share in SpecShareP to distribute over. Counting indefinites like *one book* can check their features in SpecShareP; and since Share sits above Neg in the clausal spine, the result in (9) is an *every* > *one* > *not* scope configuration. The scope configuration *every* > *not* > *one*, with the indefinite below negation, would also be syntactically derivable (Beghelli and Stowell assume that counting indefinites can remain in their base positions). But such a configuration would yield the same semantic awkwardness as the ordinary NEG-V reading in (8), and for the same reason: the distributive universal would lack a distributed share. The awkwardness of (8) and the strong preference for the *every* > *one* > *not* reading in (9)—empirical data points that go overlooked in much of the literature on scope of negation—thus receive a common explanation in Beghelli and Stowell's theory.

Beghelli and Stowell go on to note an asymmetry in the ability of distributive universals to scope below negation when they occur in object position, as sketched in (10).

(10) a. John didn't read every book. (*not* > *every* OK)
b. John didn't read each book. (*each* > *not* only)

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[3] Beghelli and Stowell choose to focus on examples with neutral intonation. They do not offer an analysis of the NEG-Q reading; they assume that the phonological characteristics typically needed to support the NEG-Q reading lead to LFs different from the ones they propose for the intonationally neutral cases.

[4] This fact is overlooked in many treatments of negation and quantifier scope. One exception is Steedman (2012: 129, 186ff.).

They propose that universals headed by *every* optionally have a group-denoting interpretation that those headed by *each* lack. This enables *every* DPs to take scope below Neg when they occur in object position, whereas *each* DPs have no choice but to raise to DistP, and thus to outscope negation. See Beghelli and Stowell (1997:98ff.) for discussion.

16.3.2 Negation and focus

When focal emphasis is present, it can lead to ambiguities in the construal of negation. Such ambiguities can involve the apparent scope of negation, but they can also involve the pragmatic felicity of the sentence in different contexts and the range of felicitous continuations. Here we explore analyses that seek to account for such ambiguities while positing a consistent semantics for negation itself.

Partee (1993) discusses the example in (11). As she notes, this sentence can be judged true in a context where Mary gave most or even all employees a raise, provided no raise was given on account of soft-heartedness. In other words, focal emphasis on *soft-hearted* yields a reading that is truth-conditionally distinct from the most salient reading of the sentence in the absence of such emphasis, which states that no employee got a raise and that the lack of raises was due (however counterintuitively) to Mary's soft-heartedness.

(11) Mary didn't give any employee a raise because she was SOFT-HEARTED.

Partee pursues an analysis of sentential negation as an unselective quantifier (cf. Lewis 1975), i.e. as the operator in a tripartite structure. The role of focus is to help partition the sentence into restriction and nuclear scope for this operator, with the focused material mapped into the nuclear scope. The overall truth conditions for (11) then state that no instance of Mary giving an employee a raise was one in which she gave that employee a raise because she was soft-hearted; put differently, for any instance of Mary giving an employee a raise, it is not the case that Mary gave that employee a raise because she was soft-hearted. As this paraphrase suggests and as Partee discusses, this allows us to treat the nuclear scope as the scope of negation, while integrating the apparent focus-sensitivity of negation into a more generally applicable framework for focus and quantification. (Partee does not take the licensing of *any* in the restriction here to warrant any particular conclusion about the restriction's falling in the semantic scope of negation; as she notes, NPI *any* is licensed quite broadly in operator restrictions.)

In a similar vein, Herburger (2000) develops an analysis in which the different construals of negation in the presence of focus are tied to the partition of the sentence into restriction and nuclear scope. In Herburger's neo-Davidsonian analysis, however, the operator is not negation itself but an event quantifier, and the ambiguities involving negation result from negation's being mapped to different positions in the articulated logical structure. For the example in (12), Herburger proposes that negation can apply to the entire nuclear scope as in

(12a), to the verb *visit* as in (12b), or to the entire proposition as in (12c). (I omit tense and contextual restrictions from these logical forms.)

(12) John didn't visit MONTMARTRE.
a. ∃e [visit(e) & Ag(J,e)] ¬[Th(M,e) & visit(e) & Ag(J,e)]
b. ∃e [¬visit(e) & Ag(J,e)] [Th(M,e) & ¬visit(e) & Ag(J,e)]
c. ¬∃e [visit(e) & Ag(J,e)] [Th(M,e) & visit(e) & Ag(J,e)]

Roughly speaking, (12a) says that there was a visiting event whose agent was John, but that Montmartre was not its theme; (12b) says that there was an event whose agent was John and whose theme was Montmartre but which was not a visiting event; and (12c) says that there was no visiting event whose agent was John and whose theme was Montmartre. Since existential quantification is semantically symmetrical, the partitioning into restriction and nuclear scope does not affect the sentence's truth conditions in any of these cases. Rather, Herburger proposes that the role of the restriction is to establish what she calls a "backgrounded focal entailment," essentially an aboutness relation. With a restriction as in (12a,c), the sentence is about events of visiting whose agent is John; with the restriction in (12b), the sentence is about events whose agent is John which are not visiting events. Each example is pragmatically appropriate in a context that makes its restriction salient. The highly articulated structure makes available a variety of scope positions for negation—in each case modeled as a propositional operator—with consequences for interpretation within the pragmatics rather than the truth-conditional semantics.

It is a bit less clear how Herburger's system would handle examples in which negation and quantifiers interact. We could in principle generate at least six different logical forms for an example like (13).

(13) John didn't read EVERY BOOK.
a. ∃e [read(e) & Ag(J,e)] ¬[every-book[x] : Th(x,e) & read(e) & Ag(J,e)]
b. ∃e [¬read(e) & Ag(J,e)] [every-book[x] : Th(x,e) & ¬read(e) & Ag(J,e)]
c. ¬∃e [read(e) & Ag(J,e)] [every-book[x] : Th(x,e) & read(e) & Ag(J,e)]
d. every-book[x] : ∃e [read(e) & Ag(J,e)] ¬[Th(x,e) & read(e) & Ag(J,e)]
e. ¬every-book[x] : [∃e [read(e) & Ag(J,e)] [Th(x,e) & read(e) & Ag(J,e)]]
f. [every-book[x] : ¬∃e [read(e) & Ag(J,e)] [Th(x,e) & read(e) & Ag(J,e)]]

The logical forms in (13a,b,c) are parallel to their counterparts in (12), with the object quantifier scoping within the nuclear scope of the event quantifier. Each of these three logical forms yields truth conditions that are too weak for either the *not* > *every* or the *every* > *not* reading of the sentence; each is compatible with a scenario in which John did in fact read every book (provided this outcome can be achieved over a collection of distinct events, in the case of (13c)). The logical form in (13d) is likewise too weak, requiring of each book merely that there be some event where John read something other than it.[5] The

[5] An anonymous reviewer suggests that this reading may indeed be available, characterizing a scenario where each book was such that John avoided reading it on some

not > *every* and *every* > *not* readings are captured by (13e) and (13f), respectively, both logical forms where negation scopes above the event quantifier. The multiplicity of available scope positions thus may overpredict the range of readings found when negation interacts with a quantifier.

16.3.3 Negation and topic

It is widely observed that the NEG-Q reading requires—or at least strongly prefers—a particular variety of discourse context and a marked intonation. In the generative tradition, there are a variety of theories of how intonation interacts with scope; a foundational early work is Jackendoff (1972). In this section, we explore the approach of Büring (1997a, 1997b), who develops a formal theory of topic and focus and shows how it can illuminate our understanding of quantifier–negation interactions.

Büring sets out to explain how intonation influences the calculation of scope. His particular focus is on sentences with a universal subject headed by *all* (not *every* or *each*) alongside sentential negation. Not being obligatorily distributive, *all* supports a NEG-V reading with neutral intonation or with an A accent (Bolinger 1965, Jackendoff 1972), where emphasis falls on *all*. By contrast, when there is a second phonological emphasis on negation, or when the sentence is intoned with the B accent, where there is a phrase-final rise in pitch, the NEG-Q reading becomes strongly preferred. The contrast is sketched in (14).

(14) a. ALL politicians are not corrupt. (A accent: NEG-V)
b. ALL politicians are NOT corrupt. (B accent: NEG-Q)

Büring assumes that the operative syntactic principles of scope assignment permit both relative scopings in (14), i.e. that the grammar generates LFs for both the NEG-V (*all* > *not*) and the NEG-Q (*not* > *all*) readings. Focusing on the case of (14b), he argues that disambiguation in favor of NEG-Q is the result of a formal pragmatic requirement that filters out the NEG-V LF due to its failure to generate what he calls a Residual Topic. Relative scope, then, is limited in this case not by any grammatical constraint on the derivation of LFs, but by a (suitably formalized) discourse coherence condition.

Büring assumes the presence of Focus and Topic features at LF that enter the recursive semantics. Büring adopts Rooth's (1985, 1992) alternative semantics for focus, where ordinary semantic values exist alongside focus-semantic values, which are sets of ordinary semantic values (e.g. sets of propositions). Büring treats topic as a kind of higher-order focus: topic-semantic values are sets of focus-semantic values (e.g. sets of sets of propositions). On a Hamblin/Karttunen semantics for questions, this makes the focus-semantic value of a sentence equivalent to a question, and the topic-semantic value of a sentence equivalent to a set of questions.

In Büring's analysis of (14b), there is a Focus feature attached to *not* and a Topic feature attached to *all*. This means that focus-semantic values will show

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occasion or other (though he may ultimately have read all of them).

variation in the position of *not*: a focus-semantic value will be a two-membered set consisting of the negated proposition in question and its affirmative counterpart. Topic-semantic values will show variation in the position of the quantificational determiner: each element will be a focus-semantic value as just described with some determiner or other in the position of *all*. When *all* scopes above *not*, as on the NEG-V reading, we get the topic-semantic value shown in (15).

(15) Topic-semantic value for *all* > *not*:
{{all(politicians)(λx.¬corrupt(x)), all(politicians)(λx.corrupt(x))},
{most(politicians)(λx.¬corrupt(x)), most(politicians)(λx.corrupt(x))},
{some(politicians)(λx.¬corrupt(x)), some(politicians)(λx.corrupt(x))}, …}

Büring's discourse coherence condition states that the utterance of a Topic-containing sentence in a given context must leave at least one element of the sentence's topic-semantic value unsettled in the updated context. Put differently, the condition states that the utterance must leave at least one of the questions that constitute the sentence's topic-semantic value unanswered, or "disputable." The disputable element(s)/question(s) remaining form what Büring calls the Residual Topic. Put as succinctly as possible, then, Büring's condition states that the utterance of a Topic-containing sentence in a given context must leave behind a Residual Topic.

Büring attributes the unavailability of the NEG-V reading in (14b) to its failure to leave behind a Residual Topic. The assertion, with *all* scoping over *not*, resolves the first question in the topic-semantic value shown in (15): there is no longer any doubt as to which of the two propositions all(politicians)(λx.¬corrupt(x)) and all(politicians)(λx.corrupt(x)) is true in the updated context. The problem is that, having asserted the truth of all(politicians)(λx.¬corrupt(x)), there is no longer any doubt as to which proposition is true in any of the other questions that make up this topic-semantic value. There is thus no Residual Topic, and the sentence is infelicitous on this reading.

The topic-semantic value for the NEG-Q reading, by contrast, where *not* scopes above *all* at LF, is as in (16).

(16) Topic-semantic value for *not* > *all*:
{{¬all(politicians)(corrupt), all(politicians)(corrupt)}, {¬most(politicians)(corrupt), most(politicians)(corrupt)}, {¬some(politicians)(corrupt), some(politicians)(corrupt)}, …}

Here uttering the sentence adds the proposition ¬all(politicians)(corrupt) to the common ground. This once again resolves the first question in the topic-semantic value, but it leaves each remaining question unresolved: if it is merely the case that not all politicians are corrupt, then it may be the case that most politicians are corrupt, or not; and so on for the other remaining questions. On this reading, then, there is a Residual Topic, and Büring's discourse coherence

condition does not filter out the underlying LF as it does in the case of the NEG-V reading.

To summarize: for Büring, the effect of intonation on the scope of negation is mediated by (i) the syntactic Focus and Topic features associated with particular intonational melodies, (ii) the semantic effects of those features within an expanded Roothian alternative semantics, and (iii) conditions on discourse coherence stated within that formal framework. Within this approach, scopal asymmetries reflect the filtering effect of discourse conditions, not lower-level constraints on the generation of logical forms. For further work within this approach, see Büring (2003) and Wagner (2009, 2012).

16.3.4 Scope of negation in Horn's Extended Term Logic

Horn (1989), in the final chapter of his classic study of natural-language negation, develops a version of Aristotelian term logic he dubs Extended Term Logic (ETL). Horn's account of scope of negation is couched within this system, whose mechanisms for introducing negation and for permitting scopal interactions between negation and quantifiers differ in important ways from the generative systems discussed above.

Within ETL there are two distinct processes that introduce negation: predicate term negation and predicate denial. Predicate term negation applies to a predicate and yields a new predicate that can compose with a subject; its semantics is that of contrary opposition. Predicate denial is a mode of composition that combines a subject and a predicate to create a proposition; its semantics is that of contradictory opposition.[6] ETL does not countenance the truth-functional negation operator familiar from propositional logic and most generative treatments.

ETL's two processes for introducing negation correspond straightforwardly to the two scope interpretations for negation: predicate term negation negates the predicate and thus yields a NEG-V reading, while predicate denial denies that a predicate holds of a (possibly quantificational) subject, yielding a NEG-Q reading. Horn's discussion focuses on cases that appear to flout the systematicity of this relationship between mode of composition and semantic interpretation; in particular, Horn is concerned with cases where predicate denial yields a NEG-V reading.

Horn's account of why a predicate denial syntax is so often paired with a NEG-V semantics makes appeal to a confluence of functional tendencies and pressures. First, Horn notes that syntactic subjects are also frequently pragmatic topics, and that topics are given or established in the discourse in a way that can conflict with negation's taking scope above them. This is true in particular for names and definite descriptions, whose existential presuppositions are often preserved under predicate denial. In this connection, Horn cites Kuroda's (1972) distinction between thetic and categorical judgments, work with roots in the

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[6] Contrary opposites cannot be simultaneously true, though they may be simultaneously false; *Everybody came* and *Nobody came* are contrary opposites. Contradictory opposites cannot share truth value, which means that exactly one of them is true and the other is false; *Somebody came* and *Nobody came* are contradictory opposites.

Prague School. In a categorical judgment, an established topic is taken up and then a predication is made of it; to deny that a predicate holds of an established topic, in this approach, is not to deny the semantic and pragmatic import of the topical phrase itself.

The pragmatic privileges of topichood are also available in principle to quantificational subjects, and as Horn notes, predicate denial often leads to a narrow-scope, NEG-V reading of negation with quantificational subjects. Of particular interest here is an asymmetry between universally and existentially quantified subjects. As shown in (17), universals appear to support the wide-scope, NEG-Q reading much more readily than existentials do.

(17) a. Everybody didn't come.
b. Somebody didn't come.

To the various functional pressures Horn cites as favoring the narrow-scope, NEG-V reading of negation in these predicate denials, he adds one more: competition with a lexicalized alternative, combined with the crosslinguistic tendency for languages to lexicalize negated existential (*not* > *some*) operators but not negated universal (*not* > *every*) ones. The NEG-Q reading of the predicate denial in (17b) can be unambiguously expressed by composing the predicate (*came*) with the lexicalized negative existential quantifier (*nobody*). The corresponding construction in the case of (17a), by contrast, requires the use of the morphologically marked phrasal constituent (*not everybody*). Horn appeals to this difference in relative markedness to explain the more ready availability of the NEG-Q reading in (17a).

As Horn (1989:494ff.) notes, when the pragmatic effects of topichood are controlled for or overridden by other discourse-pragmatic pressures, the NEG-Q reading of predicate denial can more easily emerge, regardless of the quantificational force of the subject. Horn thus does not envision a strict mapping between syntactic mode of composition and semantic scope of negation. Rather, the semantic interactions between negation and quantifiers are but one case of a broader pattern, one where pragmatic factors are a driving force in interpretation rather than a filter on grammatical outputs.

16.4 Other issues

16.4.1 Scope of incorporated and covert negation

Beyond its role as a sentential operator, negation has been argued to be a component of certain quantificational elements and phrasal constructions. Evidence in favor of this view comes from the apparent scopal independence of the negative component in such constructions. Quantifiers and constructions that have been analyzed in this way include negative existentials (also known as negative indefinites), the comparative degree operators *less* and *fewer*, and comparative *than* clauses.

The component negation analysis of negative existentials offers an account of the scope splitting found in examples like (18), with the German

negative existential *kein* (Jacobs 1980), and (19), with English *no* (Iatridou and Sichel 2011).

(18) Alle Ärzte haben kein Auto. (¬ > *alle* > ∃)
(19) No recording of this session may be made. (¬ > *may* > ∃)

In these examples, a scope-bearing element—the universal quantifier *alle Ärzte* or the modal *may*—takes scope between the negative and existential components of the negative existential quantifier (*kein Auto* or *no recording*). While the negative component is scopally independent of the existential component, the relationship between these two elements is not unrestricted: though another operator or operators may take scope between them, the negative component always scopes above the existential component. Jacobs (1980: 126) notes that the split-scope reading of (18) is most readily available with topical emphasis on *alle* and focal emphasis on *kein*, precisely the intonational pattern that demands a NEG-Q reading in the examples discussed above analyzed by Büring (1997a,b).

The comparative degree operators *fewer* and *less* (which may be analyzed as count and mass allomorphs, respectively, of the same item) are taken by Heim (2006) to consist of the positive degree operator *more* plus a scopally superior negation. Evidence comes once again from scope splitting, as in the following examples (see also Hackl 2000).

(20) a. You have to be less tall than John to ride this roller coaster; you only have to be as tall as Mary.
b. You have to answer fewer than 50 questions to get full credit; you only have to answer 30.

As the continuations above make clear, the sentences in (20) have an available reading where the modal *have to* takes scope above the degree-inequality component of the degree operator but below the negative component: a split-scope reading (schematically, ¬ > *have to* > *more*). Penka (2011: ch. 4) catalogues a number of other constructions that support split-scope readings of this sort, including *only* and modified numerals with *at most*.

Finally, there is a longstanding analysis of clausal comparatives, originating with Seuren (1973), according to which the comparative *than* clause contains a covert negation. (More recent exponents include Gajewski 2008 and Schwarzschild 2008.) Known as the “A-not-A” analysis, it has been most recently updated by Alrenga and Kennedy (2014), who propose that the negative element in the *than* clause is not a covert sentential negation but a covert negative degree operator. This covert negative’s scope is then limited by known constraints on degree-operator scope; in particular, it may not take scope above a subject quantifier within the *than* clause.

16.4.2 Negative islands

Scopal interactions between negation and interrogative operators are limited in interesting ways. In particular, when negation occurs between a degree interrogative phrase and its trace, the result is often infelicitous, as in (21). Such configurations have come to be known as negative islands. An appropriately placed modal can have a rescuing effect, as in (22) (Fox and Hackl 2006, Abrusán and Spector 2011).

(21) a. How fast was John driving?
b. # How fast wasn't John driving?
(22) a. How fast is one not allowed to drive?
b. How fast is one required not to drive?

Cinque (1990) and Rizzi (1990) propose syntactic accounts that attribute the negative island effect to a violation of Relativized Minimality (in line with other weak island effects). By contrast, Szabolcsi and Zwarts (1993) place the problem squarely in the denotational semantics. On their account, a degree interrogative quantifies over an expression with the semantic structure of a join semilattice; negation effects Boolean complementation, an operation not defined on such domains. In a similar vein, Rullmann (1995) proposes that the negative island effect is the result of a semantic crash in which the maximalization operator introduced by the degree interrogative is applied to an argument that lacks a scalar maximum.

Beck and Rullmann (1999) propose an amended semantic account that attributes the negative island effect to the failure of a maximal informativity presupposition, i.e. a presupposition that the degree question has a strongest true answer (after Dayal 1996). This account affords better empirical coverage, as the negative island effect is tied not to the matter of scalar maxima or minima but to the inferential relationships among propositions that include particular scalar values. Fox and Hackl (2006) expand on this to argue in favor of the view that scales are dense, showing that the negative island effect arises when we seek a maximally informative answer to a question about degrees above or below (but not equal to) a certain value. See Abrusán and Spector (2011) and Abrusán (2014) for additional work in this vein.

16.5 Summary

The scopal interactions between negation and quantifiers are at once straightforward to describe and difficult to explain. The core question of under what conditions a quantificational subject will be interpreted as falling within the scope of sentential negation and vice versa is one that has engendered a large literature; space has precluded an examination of anything more than a small portion of it here. Factors as varied as the syntax of subjecthood, the phrase structure of scope taking, the pragmatic partition of the sentence into focus and background, and the discourse conditions regulating topichood have been argued to play a role, directly or indirectly, in regulating these scopal interactions. Broader questions about the proper division of labor between grammatical and

extragrammatical factors, and about the line of demarcation between the two, are at play in the variety of approaches considered here. The relative scope of negation and quantifiers remains an active area of investigation still in search of a unifying account.

References

Abrusán, Márta (2014). *Weak Island Semantics*. Oxford: Oxford University Press.

Abrusán, Márta, and Benjamin Spector (2011). 'A semantics for degree questions based on intervals: negative islands and their obviation', *Journal of Semantics* 28: 107–147.

Alrenga, Peter, and Christopher Kennedy (2014). '*No more* shall we part: quantifiers in English comparatives', *Natural Language Semantics* 22: 1–53.

Baker, C. L. (1970). 'Double negatives', *Linguistic Inquiry* 1: 169–186.

Barwise, Jon, and Robin Cooper (1981). 'Generalized quantifiers and natural language', *Linguistics and Philosophy* 4: 159–216.

Beck, Sigrid, and Hotze Rullmann (1999). 'A flexible approach to exhaustivity in questions', *Natural Language Semantics* 7: 249–298.

Beghelli, Filippo, and Tim Stowell (1997). 'Distributivity and negation: the syntax of *each* and *every*', in Anna Szabolcsi (ed.), *Ways of Scope Taking*. Dordrecht: Kluwer, 71–107.

Boeckx, Cedric (2001). 'Scope reconstruction and A-movement', *Natural Language and Linguistic Theory* 19: 503–548.

Bolinger, Dwight (1965). *Forms of English: Accent, Morpheme, Order*. Cambridge, MA: Harvard University Press.

Büring, Daniel (1997a). *The Meaning of Topic and Focus: The 59th Street Bridge Accent*. London and New York: Routledge.

Büring, Daniel (1997b). 'The great scope inversion conspiracy', *Linguistics and Philosophy* 20: 175–194.

Büring, Daniel (2003). 'On D-trees, beans, and B-accents', *Linguistics and Philosophy* 26: 511–545.

Carden, Guy (1970). 'A note on conflicting idiolects', *Linguistic Inquiry* 1: 281–290.

Cechetto, Carlo (2004). ‘Explaining the locality conditions of QR: consequences for the theory of phases’, *Natural Language Semantics* 12: 345–397.

Cinque, Guglielmo (1990). *Types of A’-Dependencies*. Cambridge: MIT Press.

Dayal, Veneeta (1996). *Locality in WH Quantification: Questions and Relative Clauses in Hindi*. Dordrecht: Kluwer.

Fleisher, Nicholas (2015). ‘Comparative quantifiers and negation: implications for Scope Economy’, *Journal of Semantics* 32: 139–171.

Fox, Danny (2000). *Economy and Semantic Interpretation*. Cambridge: MIT Press.

Fox, Danny, and Martin Hackl (2006). ‘The universal density of measurement’, *Linguistics and Philosophy* 29: 537–586.

Gajewski, Jon (2008). ‘More on quantifiers in comparative clauses’, in Tova Friedman and Satoshi Ito (eds.), *Proceedings of Semantics and Linguistic Theory 18*, 340–357.

Hackl, Martin (2000). ‘Comparative quantifiers’, Ph.D. dissertation, MIT.

Heim, Irene (2006). ‘Little’, in Masayuki Gibson and Jonathan Howell (eds.), *Proceedings of Semantics and Linguistic Theory 16*, 35–58.

Heim, Irene, and Angelika Kratzer (1998). *Semantics in Generative Grammar*. Malden, MA: Blackwell.

Herburger, Elena (2000). *What Counts: Focus and Quantification*. Cambridge, MA: MIT Press.

Horn, Laurence R. (1989). *A Natural History of Negation*. Chicago: University of Chicago Press.

Iatridou, Sabine, and Ivy Sichel (2011). ‘Negative DPs, A-movement, and scope diminishment’, *Linguistic Inquiry* 42: 595–629.

Jackendoff, Ray (1972). *Semantic Interpretation in Generative Grammar*. Cambridge, MA: MIT Press.

Jacobs, Joachim (1980). ‘Lexical decomposition in Montague-grammar’, *Theoretical Linguistics* 7: 121–136.

Kratzer, Angelika (1996). ‘Severing the external argument from its verb’, in Johan Rooryck and Laurie Zaring (eds.), *Phrase Structure and the Lexicon*. Dordrecht: Kluwer, 109–137.

Kuroda, S.-Y. (1972). ‘The categorical and the thetic judgment (evidence from Japanese)’, *Foundations of Language* 2: 153–185.

Lewis, David (1975). ‘Adverbs of quantification’, in Edward L. Keenan (ed.), *Formal Semantics of Natural Language*. Cambridge: Cambridge University Press, 3–15.

May, Robert (1985). *Logical Form*. Cambridge: MIT Press.

Mayr, Clemens, and Benjamin Spector (2012). ‘Generalized Scope Economy – not too strong!’ Ms., Zentrum für Allgemeine Sprachwissenschaft and Institut Jean Nicod.

Partee, Barbara H. (1993). ‘On the “scope of negation” and polarity sensitivity’, in Eva Hajičová (ed.), *Functional Description of Language*. Prague: Faculty of Mathematics and Physics, Charles University, 179–196.

Penka, Doris (2011). *Negative Indefinites*. Oxford: Oxford University Press.

Rizzi, Luigi (1990). *Relativized Minimality*. Cambridge: MIT Press.

Rooth, Mats (1985). ‘Association with focus’, Ph.D. dissertation, University of Massachusetts, Amherst.

Rooth, Mats (1992). ‘A theory of focus interpretation’, *Natural Language Semantics* 1: 75–116.

Rullmann, Hotze (1995). ‘Maximality in the semantics of WH-constructions’, Ph.D. dissertation, University of Massachusetts, Amherst.

Seuren, Pieter A. M. (1973). ‘The comparative’, in Ference Kiefer and Nicolas Ruwet (eds.), *Generative Grammar in Europe*. Dordrecht: Reidel, 528–564.

Schwarzschild, Roger (2008). ‘The semantics of comparatives and other degree constructions’, *Language and Linguistics Compass* 2: 308–331.

Steedman, Mark (2012). *Taking Scope*. Cambridge: MIT Press.

Szabolcsi, Anna (2004). ‘Positive polarity – negative polarity’, *Natural Language and Linguistic Theory* 22: 409–452.

Szabolcsi, Anna, and Frans Zwarts (1993). ‘Weak islands and an algebraic semantics for scope taking’, *Natural Language Semantics* 1: 235–284.

Takahashi, Shoichi (2006). ‘More than two quantifiers’, *Natural Language Semantics* 14: 57–101.

Wagner, Michael (2009). ‘A compositional analysis of contrastive topics’, in Muhammad Abdurrahman, Anisa Schardl, and Martin Walkow (eds.), *Proceedings of NELS 38*, vol. 2, 455–468.

Wagner, Michael (2012). ‘Contrastive topics decomposed’, *Semantics and Pragmatics* 5: 8:1–8:54.

Zanuttini, Raffaella (1997). *Negation and Clausal Structure: A Comparative Study of Romance Languages*. Oxford: Oxford University Press.