Rethinking scope islands[1]

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Abstract: Relative clauses and tensed clauses are standardly assumed to be scope islands. However, naturally-occurring counterexamples are abundant and easy to find. Therefore we should revisit analyses that rejected Quantifier Raising on the assumption that QR is clause bounded. The data show that scope islands are sensitive to the identity of both the scope-taker and the predicate embedding the island. I propose the *scope island subset constraint*: given two scope islands, the scope-takers that can't escape one will be a subset of the scope-takers that can't escape the other. A new simple but flexible technique allows encoding and enforcing scope islands.

1 Introduction

A **SCOPE ISLAND** is a syntactic context that traps a scope-taker inside of it.

(1) Someone asked everyone to leave. $\forall > \exists$

(2) Someone thought everyone left. $*\forall > \exists$

The consensus in the literature is that inverse scope for (1) is possible, in which case there can be a different asker for each person who was asked to leave, but not for (2), which

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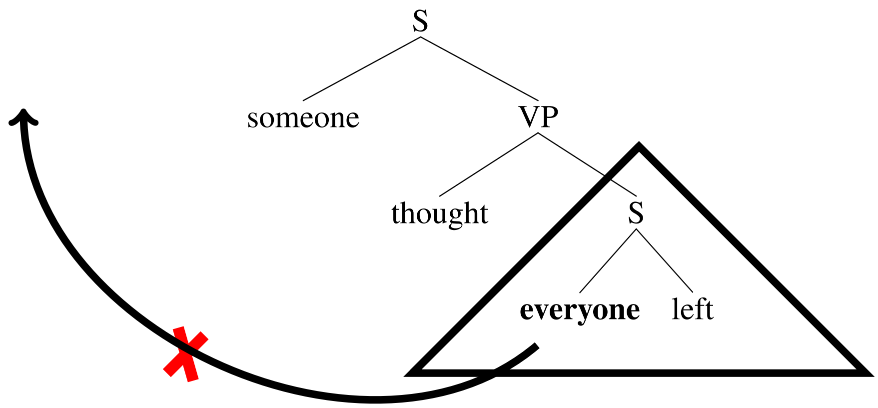

Figure 1: A scope island. The scope-taker *everyone* is unable to take scope outside of the clausal complement of *think*.

only entails the existence of one thinker and one thought. The difference is supposed to be that the embedded clause in (1) is untensed. Tensed clauses are supposed to be scope islands that trap scope-takers such as *everyone*, as illustrated in Figure 1.

Although I don't dispute the standard scopability judgments as just described, I will argue that clauses are not in general scope islands for Quantifier Raising, regardless of whether they are tensed clauses or relative clauses. I will argue that a more accurate picture requires a more fine-grained approach that is sensitive both the identity of the embedding predicate, as well as to the identity of the scope-taker in question. Thus the data in (1) and (2) show only that the complement of *think* traps *everyone*, not that clauses in general are scope islands for all scope-takers.

Islands of any sort, whether syntactic islands or scope islands, have considerable intrinsic theoretical interest. But in addition, a number of consequential decisions about how to analyze major semantic phenomena have been based at least in part on the assumption that QR is clause bounded. Notable examples include the computation of focus, the semantics of indefinites, functional relative clauses, and more. The supposed clause-bounded nature of QR motivated some non-QR scoping mechanisms, including pointwise composition, choice functions, etc. When these alternative scoping methods are placed side by side, a pattern emerges that I call the *exceptional scope conspiracy*: in each case, the net result for truth conditions is exactly what they would have been if QR had delivered the scoping directly.

At the very least, we should rethink in each case whether QR might be the right scoping mechanism after all. But even if some of the alternative approaches remain well-motivated after discounting the belief that clauses are scope islands, the conspiracy suggests that QR nevertheless provides an accurate model for all sorts of scope taking.

Of course, we must first find a way to modulate the behavior of QR in order to account for contrasts such as that illustrated in (1) and (2). I propose below a simple but flexible formal system that will encode and enforce scope islands. When the needs and limitations of a variety of scope takers are considered within a single comprehensive system, a second pattern emerges, which I call the *Scope Island Subset Constraint*: for any two scope islands, the set of scope takers trapped by one will be a subset of the scope takers trapped by the other.

2 Clauses are not scope islands

I take it that it is currently widely believe that QR is subject to some kind of clause boundedness. Therefore it is worthwhile to build a careful case that neither relative clauses nor tensed clauses are scope islands.

In this section I will present data—some old, some new—that neither relative clauses nor tensed clauses are scope islands. The presence of a scope island depends instead on the identity of the clause-embedding predicate: some predicates create scope islands, and some do not.

2.1 The beautiful idea: scope obeys constraints on overt movement

Rodman 1976 discusses the following two examples:

(3) John has dated a woman who loves every man. $*\forall > \exists$

(4) Guinevere has a bone that is in every corner of the house. $*\forall > \exists$

On the basis of (only) these two sentences, he declares that "In a relative clause the element that is relativized always has wider scope than any other element in that relative clause"—in other words, that relative clauses are scope islands. He then shows how a modification of Montague's 1973 PTQ fragment could enforce relative clauses as a scope island. He points out that the modification also makes relative clauses syntactic islands, which he considers a good result.

Chomsky 1975 challenges the accuracy of Rodman's empirical generalization.

(5) John said that everyone had left. $*\forall >$ said

Based on the observation that (5) resists inverse scope, Chomsky suggests that clauses, plain and simple, are scope islands, not relative clauses in particular. Given that relativization ignores clause boundaries (e.g., in *the man that [Ann said [Bill liked _]]*, the relativization crosses two clause boundaries), Chomsky concludes, contrary to Rodman, that with regards to scope islands and relativization, "very different principles are at work."

In his 1977 dissertation, May explores Chomsky's suggestion that clauses in general, and not just relative clauses, are scope islands. However, May endorses Rodman's idea that syntactic and semantic constraints could turn out to be a single set of constraints (May 1977, p. 2):

> [I] propose a rule, QR, which generates representations at Logical Form for sentences containing quantifiers. Well-formedness of representations at this level is determined by universal principles on the output of the rules of core grammars... [I]t follows from the Subjacency Condition that quantification is clause bounded, in the unmarked case.

Subjacency says that overt syntactic movement cannot cross more than one bounding node, where at least S counts as a bounding node. On May's 1977:172 analysis:

(6) $[_{S_2}$ John hissed $[_{\bar{S}}$ that $[_{S_1}$ Smith liked $[_{NP}$ $[_{Q}$ every painting]]]]]

In order for the universal to take scope over the matrix clause via QR, it must cross two S nodes, which would violate Subjacency. It follows that if we assume that QR obeys constraints on syntactic movement, we predict that clauses are always scope islands.

This beautiful idea—that constraints on semantic scope and syntactic movement could flow from a single source—took a powerful hold on the imaginations of a generation of semanticists. The idea is clearly articulated in recent handbook articles. Ruys and Winter 2011 write that "evidence for QR exists to the extent that generalizations on quantifier scope can be stated in terms of syntactic properties of the relevant constructions, and to the extent that these generalizations apply to other purported movement operations as well. Ultimately, on the QR approach, a unified theory explaining properties of both overt and covert movement should be possible." Likewise, Dayal 2012 writes that "Conceiving of Quantifier Raising as a syntactic rule provides a general explanation for some of the restrictions on quantifier scope... [W]hatever principles of syntax rule out the formation of overt dependencies in these constructions can be tapped to rule out the creation of problematic covert dependencies at LF."

Variations on the basic idea have been proposed. To mention just two notable examples, Huang 1982 argues that Subjacency does not apply to QR, but the ECP does, a position later taken up by May 1985:29. Cecchetto 2004 proposes that it is syntactic phases that create scope islands.

Of course, given the assumption that clauses are scope islands, one inconvenient fact for the beautiful idea is that clauses are typically not syntactic islands; they certainly are not in English. So any correspondence between syntactic islands and scope islands would have to be imperfect at best.

Since relative clauses are among the strongest syntactic islands cross linguistically, the belief that relative clauses are scope islands was consistent with the idea that syntactic islands and scope islands arise through general constraints on movement. But unfortunately for the beautiful idea, as we will see immediately below, relative clauses are not scope islands.

Despite the immediate and sustained popularity of the hypothesis, there were dissenting views. Farkas 1981 argues that QR ignores syntactic islands, and Huang's 1982 dissertation showed that in-situ wh in Mandarin scopes out of syntactic islands. In both of these cases, covert scope-taking clearly does not behave like overt syntactic movement.

2.2 Relative Clauses are not scope islands

The literature contains a number of counterexamples to the claim that relative clauses are not scope islands.

May 1977:223 himself offers a sentence that he considers to be an exception to the claim:

(7) A book [which every prisoner left] surprised the warden.

Here and in the next few examples, I've surrounded the relative clause in question in square brackets. According to May, the universal can scope over the indefinite.

Sharvit observes that (8) has an interpretation on which the universal appears to take wide scope and bind the pronoun.

(8) The woman [that every man hugged] pinched him.

We'll return to Sharvit's analysis below in section 3.4.

Based on examples like the following, Hulsey and Sauerland 2006 declare that "relative clauses are not scope islands."

(9) The picture of himself [that everyone sent in] annoyed the teacher.

Finally, Szabolcsi 2010:107 offers the following counterexample:

(10) $^{\gamma}$A timeline poster should list the different ages/periods (Triassic, Jurassic, etc.) and some of the dinosaurs or other animals/bacteria [that lived in each].

Here and throughout I'll use $^{\gamma}$ to indicate a naturally-occurring example. The context clearly expects that there will be a different list of dinosaurs for each period covered by the timeline, i.e., in which case *each* takes scope over *some*.

In addition to these examples from the literature, it is easy to find as many naturally-occurring counterexamples as desired. Here are some:

(11) $^{\gamma}$The data set represents the number of snails [that each person counted on a walk after a rainstorm]. 12, 13, 22, 16, 6, 10, 13, 14, 12

(12) $^{\gamma}$The papers are all laid out by alphabetical order, so you can see the grade [that every person got].

(13) $^{\gamma}$What is the absolute earliest [that each character can die]?

(14) $^{\gamma}$Classroom time and content vary based on the job [that each person does].

(15) $^{\gamma}$For the experiment, measure the time [that each person took to travel 20 meters].

(16) $^{\gamma}$[T]here is a role [that each person is uniquely designed by God to fulfill].

(17) $^{\gamma}$Include the name of the person [that each volunteer must report to].

(18) $^{\gamma}$Ask for the complete name of the insurance company [that will issue each policy].

(19) $^{\gamma}$Give the name [that corresponds to each abbreviation]: (a) GTP; (b) dCDP; (c) dTTP; (d) UDP.

(20) $^{\gamma}$Yet at the time [that we devised each plan], we were confident it would succeed.

(21) $^{\gamma}$Reflecting and thinking about all of this, we separate the word [that most represents each sign of the zodiac].

(22) $^{\gamma}$The following diagram sets out the stages, and the main events [that occur in each stage].

(23) $^{\gamma}$Note that the superscripts displayed are the changes [that occur to each bit when borrowing].

In each example, I've indicated the extent of the relative clause with square brackets. All of these example allow interpretations on which the universal can take scope outside of the relative clause. In several of these examples, it is clear that the intended interpretation requires the universal to take wide scope. Note that in the last six examples, the quantifier is not in subject position.

I take it that these examples illustrate that relative clauses are not in general scope islands, at the very least not for *each*, and to a lesser extent not for *every*.

If relative clauses are not scope islands, what accounts for Rodman's examples, repeated here?

(24) John has dated **a woman** who loves every man.

(25) Guinevere has **a bone** that is in every corner of the house.

These examples contrast with the data in (11) through (23), which (except for the existential construction in (16)) all contain definite relational head nouns and relative clauses in the past tense.

Perhaps more tellingly, Rodman's examples involve *every*. It is well known that *each* is a stronger island escaper, so if we want to test whether relative clauses are islands, we should test with *each*.

Putting these considerations together, we can attempt to construct an example that favors the wide scope reading by adjusting the determiner, putting the relative clause into the past tense, and replacing *every* with *each*:

(26) As part of their usual painstaking security clearance background investigation, the FBI agents tracked down and interviewed at least one woman [who had dated each man].

The context favors a scenario in which there are multiple women per man. To the extent that this example makes an inverse scope easier to access, it supports the hypothesis that an explanation for Rodman's examples does not require that relative clauses are scope islands.

More research is needed to understand the factors that are at play in Rodman's examples. But in any case, what matters here is whether there are *any* quantifiers that systematically scope out of relative clauses—and, as we have seen, there clearly are.

2.3 Tensed clauses are not scope islands

Just as for relative clauses, the literature reports a number of counterexamples to the claim that tensed clauses are scope islands.

Von Stechow 1984 and Larson 1988 each notice that universals embedded in tensed clauses in comparative clauses can take scope over the clause in which they are embedded, as indicated by the logical paraphrase of (27).

(27) Ann is taller than every professor is. $\forall x.\mathbf{taller}(\mathbf{ann})(x)$

Moltmann and Szabolcsi 1994 observe that the truth conditions of sentences like (28) are equivalent to the universal taking wide scope over the embedded interrogative, though they provide an analysis that does not involve the universal undergoing QR.

(28) Ann knows who made each dish. $\forall x.\mathbf{dish}(x) \to \mathbf{knows}(\lambda y.\mathbf{made}(y)(x))(\mathbf{ann})$

Their analysis is discussed below in section 3.5.

Fox and Sauerland 1996 observe cases in which the universal appears to scope out of the embedded clause.

(29) In general, a guide ensures that [every tour to the Louvre is fun].

They suggest that this is an illusion, that the quantification comes from the generic operator. Farkas and Giannakidou 1996 offer (30) as a counterexample to Fox and Sauerland's claim in which the universal scopes over the matrix indefinite despite no hint of genericity.

(30) A student made sure that [every invited speaker had a ride].

See also Dayal 2012 for additional discussion.

Finally, Szabolcsi 2010:107 offers (31):

(31) Determine whether [each number in the list is even or odd].

Based on a number of similar examples, her assessment is that the scope of universal quantifiers "is not always clause-bounded: *each NP* supplies solid counterexamples."

And of course, in all of the relative clause examples above, the relevant scope taker is within a tensed clause.

Additional naturally-occurring examples of universals scoping out of tensed clauses are easy to find.

***Before* and *after*:**

(32) Someone needs to clean the room after each guest has left.

(33) $^{\gamma}$After [each person had been taken], we heard a shot—one for each.

(34) $^{\gamma}$After [each person had eaten], they had a spot of kunkumam (colored powder) placed on their foreheads.

(35) $^{\gamma}$Henceforth you will see a draw method call after [each object is created]

(36) $^{\gamma}$[B]efore [each person had a turn doing the DB thrusters], that person had to do a farmer's carry of 40 meters

(37) $^{\gamma}$After [each person had a turn of leading the horse, they were given a debrief on their communication style which ranged from bored, quiet, ...

(38) $^{\gamma}$after [each person had written down his opinion on an issue] he was handed back a slip of paper presumably containing a tabulation of the opinions in the group

***When*:**

(39) $^{\gamma}$When [each person had finished his turn at shoveling], he placed the spade back into what remained of the mound.

(40) $^{\gamma}$When [each person finishes], thank them for sharing. Take a few seconds to pause in silence before the next person shares.

(41) $^{\gamma}$When [each person finishes filling out the form], they should place it back on a table and remain or leave the space.

(42) $^{\gamma}$When [each person finishes speaking], they pass the football to someone else.

***Unless*:**

(43) $^{\gamma}$Unless [each person thinks that the others will cooperate], he himself will not.

(44) $^{\gamma}$Unless [each person communicates their needs], the other family members aren't likely to help them satisfy ...

***Make sure/ensure*:**

(45) A student made sure that [every invited speaker had a ride]
== Farkas and Giannakidou's (30) above

(46) $^{\gamma}$But someone has to make sure that [each actor has what is needed at the time it is needed].

(47) $^{\gamma}$On a global scale, someone has to make sure that [each application, when introduced, doesn't send ... shock waves through the economy].

(48) $^{\gamma}$Someone needs to make sure that [each incoming report or complaint of abuse is actually being investigated].

(49) $^{\gamma}$Someone should ensure that [each tool has been returned to its proper storage location]...

(50) $^{\gamma}$Once the responsibilities are clarified, someone should make sure that [each group is doing what it is supposed to do].

The last set of counterexample is particularly revealing, since they involve verbs that take a tensed clause complement.

Given the number and the variety of counterexamples, I conclude that tensed clauses are not in general scope islands.

So what explains the examples motivating the belief that Quantifier Raising is clause bounded? Here is May's 1977:171 entire data set motivating the claim that QR is clause bounded:

(51) Jones hissed that Smith liked every painting in the Metropolitan.

(52) John quoted Bill as saying that someone had left.

(53) His mother said loudly that everyone had to go.

(54) Susan didn't forget that many people had refused to contribute.

(55) Helen grieved that each of the monkeys had been experimented upon.

(56) It is instructive for someone to play the piece first.

(57) It's impossible for The Kid to fight a contender.

(58) It's false that all the men left the party.

(59) John asked whether he had bought some shuttlecocks at Abercrombie's.

(60) Carol wondered why everyone was reading *Gravity's Rainbow*.

(61) Mark regretted Sam's having invited so few people.

It has been well-known since the early 1980's that the scope of indefinites is not clause bounded, so we can disregard (52), (54), (56), (57), and (59). (Wide-scope indefinites are discussed below in section **??**.) The literature on pair-list readings argues that universals can in effect scope over wh-questions, which allows us to also set aside (60).

The remaining predicates are all attitude verbs or verbs of communication: *hiss*, *say*, *grieve that*, *regret*, and (arguably) *be false*. This suggests an alternative hypothesis: the complement of attitude verbs is a scope island for *every* and *each*. The prediction is that if we can find a clause-embedding verb that is not an attitude verb, it might potentially allow universals inside of its complement to scope out. And this is exactly what we found above for *ensure* and *make sure*.

Again, what matters here is whether there are *any* situations in which universals scope out of a tensed clause—and we have seen abundant evidence that there are.

So here's what the evidence so far shows: universal quantifiers can systematically scope out of clauses, including relative clauses and tensed causes. It follows that clauses as a class are not scope islands. Furthermore, it is clear that whether a universal can scope out of a clause depends on the embedding predicate: if the embedding predicate is *think*, it cannot, but if the embedding predicate is *make sure*, it can. Therefore any adequate theory of scope islands must allow scope islands to be created on a per-predicate basis.

3 The "exceptional scope" conspiracy

The supposed islandhood of clauses guided important decisions about the right way to analyze semantic phenomena. So if clauses are not in fact scope islands, we need to rethink those decisions.

On the assumption that QR is clause bounded, when a scope-taker takes scope outside of its local clause, it is often said to take "exceptional" scope, presumably via some mechanism other than QR. In this section, I'll show that after examining a number of cases, a suspicious pattern emerges:

> **The "Exceptional Scope" Conspiracy**: Non-QR scoping mechanisms deliver the same truth conditions that QR would have if we ignored islands.

The following subsections will briefly present a case for indicting five theories as co-conspirators.

3.1 Focus

Rooth's 1985 dissertation composes focus meanings via pointwise combination of sets of alternatives. Rooth considers using QR as a scoping mechanism for computing focus, but rejects QR for two main reasons. The first reason is that association with focus is not clause bounded, and so presumably can't be handled by QR; and the second reason is that alternative sets provide an elegant account of multiple foci.

But, as we've seen, QR is not clause-bounded! This motivates rethinking the composition of focus. Multiple foci are no impediment; see Krifka 1992 for an approach to multiple foci that does not rely on alternative sets. Rooth himself in his 1996 handbook article discusses the tradeoffs between QR and alternative sets for handling multiple foci, nested foci, and variables bound by focussed antecedents. He concludes that "we might as well adopt scoping [i.e., QR] or some other compositional mechanism with a semantics of lambda binding as our compositional semantics for focus."

3.2 Indefinites

It is well known that the scope of indefinites is definitely not clause bounded. Fodor and Sag 1982 argued that the scope of indefinites is either clause bounded or maximal (root level). Farkas 1981 discovered that (62) has an additional interpretation on which the indefinite takes scope at a strictly intermediate level, in this case, outside of its local clause but inside the scope of *each*.

(62) Each student read every paper that discussed a particular problem. $\forall > \exists > \forall$

Faced either with abandoning clauses as a scope island, or seeking a principled explanation for the behavior of indefinites, the field began the search for a non-QR account of indefinite scope.

Abusch 1994 explained how to understand indefinite scope as a consequence of Heim's 1982 proposal that indefinites contributed properties rather than quantifiers.

Reinhart 1997, Kratzer 1998, and Winter 1995 each argued that indefinites could contribute a variable with the type of a choice function ($(\mathtt{e} \to \mathtt{t}) \to \mathtt{e}$). That variable was either bound by a spontaneously generated existential quantifier ("existential closure"), or by context.

For all of these theories, the reason that indefinites were not clause-bounded was simple: they contributed a variable, not a quantifier; and since they weren't quantificational, they didn't need to take scope. This strategy enabled QR to catch all the universally-quantified tuna in its clause-bounded net, at the same time the indefinite dolphins swam free.

Schwartzschild 2002 discussed singleton indefinites: indefinites whose restrictions were pragmatically limited to an extension of cardinality 1, in which case the indefinite could have its scope limited by scope islands, yet the truth conditions would be equivalent to wide scope interpretations.

A separate strand of the literature (Kratzer and Shimoyama 2002, Alonzo-Ovalle 2006, Charlow 2019) proposes that indefinites contribute sets of alternatives, in much the same way that focused phrases do in Rooth's alternative semantics for focus. And just as for focus composition, the sets of alternatives are composed via pointwise function composition.

What is most relevant here is that in each of these proposals, the reason indefinites are not clause bounded is supposed to be because they take scope via some mechanism other than QR; and in each of these proposals, the net effect of the alternative scoping mechanism is equivalent to what we could have derived by using a non-clause-bounded version of QR. That is, alternative semantics is perfectly in accord with the expectations of the exceptional scope conspiracy.

Schwarz 2001 detected signs of the conspiracy, observing that “indefinites can often be interpreted as if they had scoped from a syntactic island.”

An important caveat: Reinhart 1997 shows that standard generalized quantifier theory gives the wrong result for cardinal quantifiers.

(63) If three of my relatives die, I’ll inherit a fortune.

We can’t simply use QR to scope *three of my relatives* out of the conditional, since that would predict a reading that entails that the speaker could inherit as many as three fortunes, one for each relative, an interpretation that is not available for (63).

The diagnosis in Szabolcsi 2010 chapter 7 is that indefinites (along with other types of scope-takers) systematically give rise to two layers of quantification: an existential quantification over plural (sum) individuals (in (63), over sums of three relatives), and a distributive quantification over the elements of the sum. These two quantificational elements have different scoping potentials. In particular, the existential component can take arbitrarily wide scope, just like an ordinary singular indefinite can, but the distributive component will be trapped by more local scope islands, just as if it were an ordinary universal quantifier. Charlow’s 2019 detailed account of this kind of ‘split scope’ using higher-order traces is fully compatible with the fragment below.

3.3 Functional indefinites

Building on Reinhart 1997, Winter 1997, and others, Schwarz 2001 argues that there are two kinds of indefinites: the kind that can be accurately represented by an existential quantifier with the appropriate scope, and functional indefinites.

(64) If every student improves in a (certain) area, no one will fail.

$\exists f.\mathbf{if}(\forall x.\mathbf{improves}(x)(f(x)(\mathbf{area})))(\mathbf{no\text{-}fail})$

Schlenker 2006 shows that the truth conditions for (64) are not equivalent to any configuration of *if*, $\forall$, and $\exists$. He shows that allowing the indefinite to denote a Skolemized choice function will work, i.e., allowing the variable f in the truth conditions above to have the type $\mathtt{e} \to (\mathtt{e} \to \mathtt{t}) \to \mathtt{e}$. Note that the existence of functional indefinites does not refute the conspiracy hypothesis; even taking the data at face value, all it shows is that there are semantically two kinds of indefinites, differing only in whether they quantify over ordinary choice functions or Skolemized choice functions. Both kinds rely on the introduction of an existential quantifier, and QR remains eminently well-suited to delivering that existential to its scope position.

Bumford 2015, building on insights of Solomon 2011, points out that functional indefinites, like pair-list readings and certain other phenomena, only arise in the presence of a small number of distributive quantifiers, essentially *every* and *each*. For instance, the example above in (64) crucially contains an occurrence of *every*. Bumford suggests that it is the semantics of the distributive quantifiers that is special, and he provides a semantics on which the independently-motivated semantics of the distributive quantifiers, along with an appropriately dynamic theory of indefinites, delivers the functional reading even though the indefinites contribute a completely ordinary simple existential meaning.

In any case, the conspiracy theory remains viable throughout this discussion of indefinites: no matter what scoping mechanism is proposed, the truth conditions end up being exactly what they would be if the indefinite introduced an existential quantifier that took scope via QR.

3.4 Functional Relative Clauses

Sharvit 1999 discusses a class of examples in which a universal appears to take scope outside of a relative clause:

(65) ha-iSa Se kol gever xibek cavta oto [Hebrew]

the-woman that every man hugged pinched him

For every man *x*, the woman that *x* hugged pinched *x*.

Sharvit reports that functional relative clauses are only available in Hebrew when the universal in question is in subject position in the relative clause, as reflected in the definition in (66). Farkas and Giannakidou 1996 make a similar observation about when universals can scope out of relative clauses in Greek. However, as we have already seen in (10) and in (18) through (23) there is no subject requirement in English.

Sharvit remarks that "if Scoping (Quantifier Raising or 'quantifying in') is clause-bounded, as is often argued, it cannot be the mechanism responsible for these readings." This consideration is a significant factor motivating an analysis based on a special-purpose silent relativization type-shifting operator ('Op'):

(66) $[\text{Op QNP}] \to \lambda K \lambda P \lambda T \lambda R \exists A[W([\text{QNP}], A)\ \&\ \forall x \in A[R(T(\lambda g[\text{Dom}(g) = A$
$\&\ \forall y \in A[P(g(y))\ \&\ K(g, y)]]])(x), x)]]$

This operator expects an adjacent quantifier ('QNP'). It finds the unique witness A for the quantifier (which requires that the quantifier is upward monotonic, such as a universal quantifier rather than an existential), and quantifies over the atomic elements of the witness set. Here K is the content of the rest of the relative clause (*hugged*), P is the content of the head noun that the relative clause modifies (*woman*), T is the determiner (*the*), and R is a relation formed by abstracting a pronoun position contained within the continuation of the determiner phrase (*pinched him*). The operator collects these pieces and reassembles them in such a way that the net effect is exactly as if the universal had undergone QR to a position taking scope over the matrix sentence. In other words, the operator is engineered to fulfill the expectations of the conspiracy hypothesis.

3.5 "Scope island? Scope the island!"

There is a well-known technique for obeying the letter of the standard wisdom on scope islands while flouting the spirit. Even if scope takers remain unable to scope out of their minimal clauses, those clause themselves can be raised, and, under various assumptions, scope takers trapped inside the raised clause can in effect take exceptional scope. Charlow 2019 calls this "scoping the island," and views it as a similar to Nishigauchi's 1990:42 covert pied piping of wh expressions embedded in islands. (The title of this subsection is advice that Nick Fleisher (personal communication) gives graduate students who need to cope with the incorrect predictions of making QR clause-bounded.)

Scoping the island is conspiratorial behavior: the net result is exactly as if the original scope-taker had scoped out of what was incorrectly assumed to be an island.

Moltmann and Szabolcsi 1994 and Szabolcsi 1997 offer empirical evidence in favor of island-scoping.

(67) a. Some librarian or other found out which book every student needed.

b. 'for every student, there is some librarian who found out which book he needed'

They note that it is "standardly assumed" (Szabolcsi 1997: "generally agreed") that QR is clause bounded. Moltmann and Szabolcsi propose an analysis that respects this assumption. On their analysis, the universal takes scope (only) over the complement of *found out*. Rather than returning a quantified proposition as usual, it returns a function from clause continuations to propositions. For instance, in (67a), the relevant continuation is λq.*some librarian or other found out* q. The net result is "exactly the same as what we would get if *every student* scoped out on its own". In other words, this is a clear example of the exceptional scope conspiracy.

Moltmann and Szabolcsi 1994 and Szabolcsi 1997 argue in support of their analysis.

(68) More than one_i librarian found out which book every boy stole from her_i.

If *every boy* QRs to matrix position, nothing prevents *one librarian* from binding *her*, as in *More than* $\textit{one}_i$ *librarian gave every boy* $\textit{her}_i$ *email address*. But if the entire embedded clause takes scope, the pronoun is lifted along with the embedded clause to a position where it can't be bound by *one librarian*. Moltmann and Szabolcsi report that native speaker intuitions favor the island-scoping analysis and not the direct QR analysis.

However, binding is notoriously sensitive to pragmatic factors. If we adjust the pragmatics, the bound reading becomes noticeably easier:

(69) In fancy restaurants around here, more than one$_i$ waiter always asks which type of water (still or sparkling) every customer wants him$_i$ to bring to the table.

At least some native speakers get a reading on which sets of waiters covary with customers, at the same time that the pronoun is bound by *one waiter*.

Charlow 2019 advocates scoping the island as a general technique for handling wide-scope indefinites. In Charlow's formal system, indefinites introduce alternatives, which combine via pointwise composition to in effect take scope over their minimal clause, respecting the assumption that clauses are scope islands. The same mechanism then allows the clause, which now denotes a set of alternative propositions, to take scope over *its* embedding clause, and so on. The truth conditions work out exactly as predicted by the scope conspiracy hypothesis: as Charlow put is, it's as if "the indefinite had directly undergone one vast island-disrespecting scoping." Clearly conspiratorial.

3.6 Is QR the one true scoping mechanism?

If this conspiracy is real, what could lie behind it? One obvious possible explanation is that all scope taking is accomplished by Quantifier Raising after all. Of course, QR would have to be supplemented with some general way of imposing scope constraints. In section 5 I propose just such a system, and show how it can account for a wide variety of scope island effects.

Another possibility is that QR accurately approximates multiple scoping strategies because scope taking is scope taking: there is really only one way for an expression to take a portion of its surrounding context as its semantic argument. Then the reason that QR serves as such a good general scoping mechanism is because it is ‘pure’ scope taking, that is, scope taking without any additional requirements.

In any case, it remains quite possible that natural languages make use of more than one scope-taking mechanism. There may be good reasons—that is, reasons other than a mistaken belief that clauses are scope islands—for appealing to non-QR scoping mechanisms for certain phenomena, even if they deliver truth conditions equivalent to those QR would give.

But even if so, we can still use QR as a uniform mechanism to describe a wide range of scope-taking phenomena. As we’ll see in the next section, placing a number of different scope taking elements side by side within a single grammatical framework can reveal systematic patterns that might not have been obvious otherwise.

4 The subset constraint

The data in the previous sections support the following claims:

- Relative clauses are not scope islands
- Clauses are not scope islands
- Scope islands are created on a per-predicate basis (e.g., the complement of *think* is a scope island for universals, but *make sure* is not)

- Scope islands trap some scope-takers but not others (e.g., indefinites can escape from some islands that universals cannot)

This section poses the following research question: how many different kinds of scope islands are there? The methodological goal here is to imagine a worst-case scenario in which we need several distinct flavors of scope island. It's not as bad as it might have been, however: I'll argue that the various flavors obey a systematic pattern that I will call the *subset constraint*.

The traditional answer to the question of how many types of islands we need is "one". On this view, a scope island traps all and only elements that take scope via QR, including universals, leaving all other scope takers free to scope as widely as their non-QR scoping methods allow.

However, since we are exploring the possibility that all scope-taking can be implemented via QR, we'll need to find a way to allow various scope takers to escape from some islands but not others. This should not be too traumatic, given that syntacticians have long recognized that some syntactic islands are sensitive to the identity of the extracted expression, the so-called 'weak islands' (see Szabolcsi and Lohndal 2017 for an overview).

For instance, we've seen that universals can take scope outside of the complement of *make sure*. It seems unlikely, however, that downward-monotone quantifiers like *no one* can ever scope out of an embedded clause.

(70) a. Someone thought that no one left. $*\neg\exists > \exists$

b. Someone thought that everyone left. $*\forall > \exists$

(71) a. Someone made sure that no one left. $*\neg\exists > \exists$

b. Someone made sure that everyone left. $\neg\forall > \exists$

The predicate *thought* traps both the downward monotone quantifier and the universal, but the predicate *made sure* traps only the downward monotone one. That means we'll need at least two types of islands, since we need to make a three-way distinction between downward monotone quantifiers, universals, and indefinites.

Weak negative polarity items (NPIs) like *anyone* motivate adding a third type of island. The contribution to truth conditions of an NPI is equivalent to that of a narrow-scope indefinite (setting aside contrastive widening effects, which are independent of quantificational force and scope of quantification):

(72) a. I will never vote for a republican.

b. I will never vote for any republican.

Chierchia 2013:28 comments that in non-contrastive environments, these sentences are "perfectly interchangeable" (cue the conspiracy theme music...).

It follows from any viable theory of negative polarity that the scope of an NPI must be narrower than some licensing operator. But merely guaranteeing that an NPI must take scope within its licensing context is not enough to get the scope facts right. The reason is that when an NPI has two potential licensors, it must be licensed by the *closest* potential licensor.

(73) Ann doubts Bill didn't see anyone. *doubt $> \exists >$ not

Even though *doubt* is a potential licensor (*Ann doubts Bill saw anyone*), the scope of the NPI in (73) is trapped inside the embedded negation. This is precisely what we should expect if all licensing operators, including sentence negation, are scope islands for weak NPIs.

What this means for the question at hand is that although NPIs can escape from the complement of *think*, the complement of *doubt* traps NPIs, but not ordinary indefinites:

(74) a. Ann doubts Bill thinks anyone left. $\exists >$ thinks

b. Ann doubts anyone left. $*\exists >$ doubts

c. Ann doubts someone left. $\exists >$ doubts

Thus the kind of island that traps the scope of NPIs must differ both from those that trap universals and those that trap indefinites.

In fact, it turns out that there may be contexts that trap the scope even of ordinary indefinites. I'm not aware of any place in the literature where this has been noted:

(75) Ann only showed a book to BILL. $*\exists >$ only

When an indefinite occurs in the focus domain of VP-modifier *only*, it must take scope inside the focus domain. That is, (75) does not have an interpretation on which it entails the existence of a specific book *x* such that the only person Ann gave *x* to was Bill (which would be compatible with there being a different book *y* that Ann gave to several people).

For theorists who favor treating indefinites as introducing alternatives, this new observation may be welcome. Since *only* manifestly collapses the alternatives introduced by the presence of a focus operator, we might expect that it will capture the scope of any other alternative-introducing operators, including indefinites.

Unfortunately, it's not quite that simple. As Charlow 2019 observes, different indefinites can take scope over different regions.

(76) If [a persuasive lawyer visits a rich relative of mine], I'll inherit a house.

He observes that either or both of the indefinites can take scope inside or outside of the antecedent of the *if* clause. Charlow accomplishes this by allowing (rather, failing to prohibit) higher-order scope-taking, which produces layers of scope-taking. Glossing over the technical details, lower layers can be collapsed without preventing higher layers from taking wider scope. And in general, the various semantic operators that have been supposed to introduce alternatives (indefinites, disjunction, weak NPIs, etc.) all have scope domains that are independent of each other when focus is not present.

Given indefinite layering, the natural expectation is that *only* could associate with one or more of the lowest layers of alternatives, in which case an indefinite could potentially escape. Forcing *only* to always capture all layers would require special stipulation. On the formal account developed below, the desired result falls out from making the complement of *only* a kind of island that traps indefinites.

Is the focus domain of *only* such a strong island that nothing escapes? No: expressives can escape from any island.

(77) Ann said she only showed the damn book to BILL.

It is the speaker, not Ann, who is committed to the expressive contribution of *damn*. It is not self-evident that expressives should be analyzed as scope-takers, but in the spirit of the exceptional scope conspiracy described above, a scoping analysis certainly works here.

We can now take stock. In the chart below, a ‘*’ indicates that there is empirical data suggesting that the scope-taker at the top of the column cannot escape from the scope island created by the predicate on the left.

	damn	someone	anyone	everyone	no one	**Island strength:**
only		*	*	*	*	4
doubt			*	*	*	3
thought				*	*	2
make sure					*	1
	4	3	2	1	0	←**Escaper strength**

There is an obvious pattern: all of the stars are bunched up in the top right corner. This motivates the following generalization:

> **The scope island subset constraint** (island version): given any two scope islands, the scope-takers trapped by one is a subset of the scope-takers trapped by the other.

If the subset constraint holds in general, we can always associate each scope island with an element in a strict ordering, and we can think of that element as the strength of the island in question. For instance, in the chart above, the complement of *thought* is assigned an island strength of 2, since it traps universal and downward monotone quantifiers. There is nothing special about using integers to index island strength, any well-ordered set will do.

Likewise, we can characterize the island-escaping capacity of each scope-taker by associating it with the strength of the strongest island it is able to escape. Thus indefinites like *someone* are assigned an island-escaping strength of 3, since they can escape from all three types of verb complement.

There is a second, completely equivalent way to state the constraint:

> **The scope island subset constraint** (scope-taker version): given any two scope takers, the set of scope islands that trap one is a subset of the set of scope islands that trap the other.

The two formulations are equivalent in the sense that a counterexample to one is also a counterexample to the other. They both predict that there will never be a case like the following:

	scope taker X	scope taker Y
island A		*
island B	*	

This is a case in which the scope takers trapped by one island are in complementary distribution with the scope takers trapped by the other.

To illustrate the predictions of the subset constraint, consider the predicate *think*, which traps universals like *everyone* but not indefinites like *someone*. The subset constraint predicts that there can never be a predicate of English that traps indefinites but not universals. As far as I know, this prediction is correct.

However, there are situations in which a universal can appear to take wider scope than an indefinite.

(78) What did everyone buy?

(79) What did someone buy?

The question in (78) has a pair list interpretation, on which a suitable answer could be 'Ann bought a book, Bill bought a record...'. In contrast, there is general agreement (e.g., Krifka 2001) that (79) does not have a corresponding wide-scope reading, which would convey roughly 'For some person *x*, tell me what *x* bought'.

The reason this is not a counterexample to the subset constraint is that the unavailability of the indefinite scoping over the interrogative in (79) is not due to the interrogative begin a scope island, since indefinites can easily scope out of interrogatives in other contexts:

(80) Ann knows what someone bought. $\exists >$ know

This example allows scoping the indefinite out of the interrogative, in which case there is a particular person such that Ann knows what that person bought. If so, then interrogatives as a class are not scope islands for indefinites. And indeed, Krifka 2001 proposes that the unavailability of the indefinite wide scope reading for (79) is due to the incompatibility of the so-called choice reading with the pragmatics of the speech act of asking a question, not on the interrogative clause constituting a scope island for indefinites.

5 Encoding and enforcing islands

Now that we have an empirical target to aim for, I will propose a simple grammatical formalism that can encode and enforce scope islands.

In order to create scope islands on a per-predicate basis, we must be able to annotate the lexical category of each predicate to indicate which ones create islands and which ones don't. Furthermore, in order to allow the various scope islands to selectively trap some scope takers but not others, the lexical entries must further specify which exact flavor of island each predicate creates.

Figure 2 illustrates a simple way to manage scope islands. Using standard categorial grammar notation, a predicate will have a functional type of the form $A\backslash B$ (a predicate that follows its complement) or B/A (a predicate that precedes its complement). We can elaborate these categories with an index corresponding to the type of island that predicate creates. For instance, based on the table above, we can assign *thought* to the lexical category $(\mathrm{DP}\backslash\mathrm{S})/_2\mathrm{S}$.

We can use the same technique to encode the island-escaping strength of a scope-taker. For instance, we can assign *someone* to the category $\mathrm{S}/(\mathrm{DP}\backslash_3\mathrm{S})$, and *everyone* to the category $\mathrm{S}/(\mathrm{DP}\backslash_1\mathrm{S})$. These lexical categories have the semantic type of a generalized quantifier, that is, $(\mathtt{e} \to \mathtt{t}) \to \mathtt{t}$. In particular, the subcategory $\mathrm{DP}\backslash_n\mathrm{S}$ specifies the type of the nuclear scope of the quantifier, namely, $\mathtt{e} \to \mathtt{t}$, where DP determines the type $\mathtt{e}$ of the trace left by Quantifier Raising.

With these lexical categories in place, here is how scope islands will be enforced: after executing Quantifier Raising, if the path between a quantifier and its trace crosses a node with an equal or higher index, that's an island violation. See Figure 2.

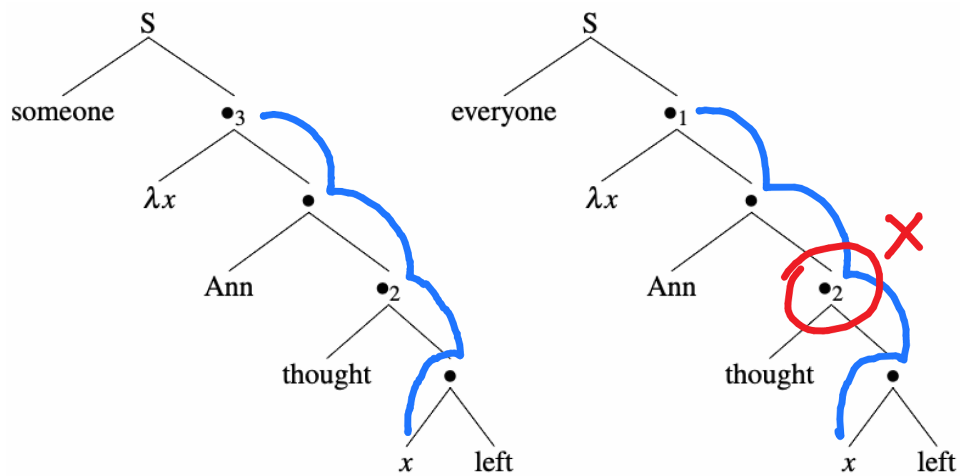

Figure 2: Enforcing island restrictions for *Ann thought someone/everyone left*. If the path from a QR-raised scope-taker crosses a node with a strength higher than the strength assigned to the scope-taker, a violation occurs. On the left, the path corresponding to a scope-taker with strength 3 can cross an island of strength 2 without creating a violation. On the right, the path of a scope-taker of strength 1 crosses an island of strength 2, creating a violation. (Unlabeled nodes have strength 0.)

We can construct a small fragment based on the table above.

ann, bill	DP	no one	$S/(DP\backslash_0 S)$	ensure	$(DP\backslash S)/_1 S$
dog	N	everyone	$S/(DP\backslash_1 S)$	thought	$(DP\backslash S)/_2 S$
left	$DP\backslash S$	anyone	$S/(DP\backslash_2 S)$	doubt	$(DP\backslash S)/_3 S$
the	DP/N	someone	$S/(DP\backslash_3 S)$	only	$(DP\backslash S)/_4\textsc{foc}$
saw	$(DP\backslash S)/DP$	damn	$\textsc{ut}/((N/N)\backslash_4 S)$	FOCUS	$(\textsc{foc}/(DP\backslash_4(DP\backslash S)))/DP$

The following derivations will illustrate the predictions of this tiny lexicon.

(81) a. Someone ensured no one left.

b. someone (ensured (no one left))

(82) a. Someone ensured everyone left.

b. someone (ensured (everyone left))

c. everyone (λx (someone (ensured (left x))))

These semantic analyses were produced mechanically by the algorithm described in the next subsection. For each example, the complete set of interpretations produced by the algorithm are given. So the fact that (81) displays just one interpretation while (82) displays two shows that *everyone* is a stronger island-escaper than *no one*.

(83) a. Ann thought everyone left.

b. (thought (everyone left)) ann

(84) a. Ann thought someone left.

b. (thought (someone left)) ann

c. someone (λx ((thought (left x)) ann))

Likewise, *someone* is a stronger island-escaper than *everyone*.

The complement of *doubt* traps weak NPIs, but not ordinary indefinites:

(85) a. Ann doubts anyone left.

b. (doubts (anyone left)) ann

(86) a. Ann doubts someone left.

b. (doubts (someone left)) ann

c. someone (λx ((doubts (left x)) ann))

Although ordinary indefinites can take scope out of many islands that trap other types of scope-takers, it is not true that they can always take wide scope.

(87) a. Ann only thought someone saw BILL.

b. (only $\langle$BILL, λx (λy ((thought (someone (λz ((saw x) z)))) y))$\rangle$) ann

c. (only $\langle$BILL, λx (λy (someone (λz ((thought ((saw x) z)) y))))$\rangle$) ann

For the sake of concreteness, I've adopted a structured meaning approach to focus in the style of, e.g., Krifka 1992, in which the focus particle *only* takes an ordered pair consisting of the focussed phrase and a continuation created by abstracting the focussed phrase; nothing hangs on this choice. When *someone* takes scope under *thought*, as in (87b), the property that Bill alone possesses is having Ann think this: that someone saw him. When *someone* takes scope over *thought*, as in (87c), the distinctive property involves Ann having thoughts about specific people seeing other people. The difference in truth conditions is subtle, and has to do with whether Ann's thoughts can be described using indefinite meanings.

The point of interest here is that there is no reading on which *someone* takes scope over the entire focus domain, which would entail the existence of some person x such that it was only Bill that Ann thought x saw. As discussed above, this reading does not appear to be an available reading for (87a), as predicted by making the complement of *only* a scope island too strong for even indefinites to climb out of.

Finally, no scope island is strong enough to trap an expressive like *damn*:

(88) a. Ann only thought the damn dog saw BILL.

b. damn (λx ((only ($\langle$BILL, (λy (thought ((saw y) (the (x dog))))))) ann))

Unlike indefinites, *damn* can escape even from a focus domain. In the terminology of Potts 2005, expressives are *speaker-oriented*: they always commit the speaker to certain attitudes, no matter how deeply the expressive is embedded.

5.1 A formal implementation using type logical combinators

As illustrated in figure 2, the algorithm works by examining each local step in the path from trace position to scope position. Therefore an implementation must break down each instance of Quantifier Raising into a series of strictly local steps. This is exactly how the combinator-based type logical grammar proposed in Barker 2007 works (see also Barker and Shan 2014 chapter 13), so that grammar is well suited to implementing scope islands.

$$\frac{\Gamma \vdash A \quad \Sigma[B] \vdash C}{\Sigma[\Gamma \bullet_i A\backslash_i B] \vdash C}\,\backslash L \qquad \frac{A \bullet_i \Gamma \vdash B}{\Gamma \vdash A\backslash_i B}\,\backslash R \qquad \frac{}{A \vdash A}\,\text{Axiom}$$

$$\frac{\Gamma \vdash A \quad \Sigma[B] \vdash C}{\Sigma[B/_i A \bullet_i \Gamma] \vdash C}\,/L \qquad \frac{\Gamma \bullet_i A \vdash B}{\Gamma \vdash B/_i A}\,/R$$

$$\frac{\Gamma}{\overline{\Gamma \bullet_i \mathsf{I}}}\,\mathsf{I} \qquad \frac{(\Delta \bullet_j \Gamma) \bullet_i \Pi}{\overline{\Delta \bullet_j (\Gamma \bullet_i (\Pi \bullet_0 \mathsf{B}))}}\,\mathsf{B} \qquad \frac{\Gamma \bullet_i (\Delta \bullet_j \Pi)}{\overline{\Delta \bullet_j (\Gamma \bullet_i (\Pi \bullet_0 \mathsf{C}))}}\,\mathsf{C}$$

This is a standard type-logical grammar with multiple modes of syntactic combination (Moortgat 1997), where each integer mode i or j is construed as a distinct flavor of island. The combinators I, B, and C are implemented here as logical constants, that is, zero-ary structural logical connectives (see Restall 2000). The double lines in the structural postulates indicate that the inferences are bidirectional. Islands are enforced by only allowing the structural postulates to be instantiated for choices of i and j such that $j \geq i$. The net effect is that if $j \ngeq i$, mode i is an island wrt mode j.

I'll illustrate a successful escape from a scope island with a derivation of *Ann thought someone left* on which *someone* takes wide scope over *thought*. Although this derivation contains many details, it is merely a algorithmically explicit accounting of the Quantifier Raising analysis diagrammed in figure 2 above, and is fully equivalent.

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}{\mathrm{DP} \bullet ((\mathrm{DP}\backslash \mathrm{S})/_2\mathrm{S} \bullet_2 ((\boxed{\mathrm{DP}} \bullet_3 \mathsf{I}) \bullet \mathrm{DP}\backslash \mathrm{S})) \vdash \mathrm{S}}\mathsf{I}
}{\mathrm{DP} \bullet ((\mathrm{DP}\backslash \mathrm{S})/_2\mathrm{S} \bullet_2 (\boxed{\mathrm{DP}} \bullet_3 (\mathsf{I} \bullet (\mathrm{DP}\backslash \mathrm{S} \bullet \mathsf{B})))) \vdash \mathrm{S}}\mathsf{B}
}{\mathrm{DP} \bullet (\boxed{\mathrm{DP}} \bullet_3 ((\mathrm{DP}\backslash \mathrm{S})/_2\mathrm{S} \bullet_2 ((\mathsf{I} \bullet (\mathrm{DP}\backslash \mathrm{S} \bullet \mathsf{B})) \bullet \mathsf{C}))) \vdash \mathrm{S}}\mathsf{C}^{\dagger}
}{\boxed{\mathrm{DP}} \bullet_3 (\mathrm{DP} \bullet (((\mathrm{DP}\backslash \mathrm{S})/_2\mathrm{S} \bullet_2 ((\mathsf{I} \bullet (\mathrm{DP}\backslash \mathrm{S} \bullet \mathsf{B})) \bullet \mathsf{C})) \bullet \mathsf{C})) \vdash \mathrm{S}}\mathsf{C}
}{\mathrm{DP} \bullet (((\mathrm{DP}\backslash \mathrm{S})/_2\mathrm{S} \bullet_2 ((\mathsf{I} \bullet (\mathrm{DP}\backslash \mathrm{S} \bullet \mathsf{B})) \bullet \mathsf{C})) \bullet \mathsf{C}) \vdash \mathrm{DP}\backslash_3 \mathrm{S}}\backslash R
\quad \mathrm{S} \vdash \mathrm{S}
}{\boxed{\mathrm{S}/(\mathrm{DP}\backslash_3 \mathrm{S})} \bullet (\mathrm{DP} \bullet (((\mathrm{DP}\backslash \mathrm{S})/_2\mathrm{S} \bullet_2 ((\mathsf{I} \bullet (\mathrm{DP}\backslash \mathrm{S} \bullet \mathsf{B})) \bullet \mathsf{C})) \bullet \mathsf{C})) \vdash \mathrm{S}}/L
}{\mathrm{DP} \bullet (\boxed{\mathrm{S}/(\mathrm{DP}\backslash_3 \mathrm{S})} \bullet ((\mathrm{DP}\backslash \mathrm{S})/_2\mathrm{S} \bullet_2 ((\mathsf{I} \bullet (\mathrm{DP}\backslash \mathrm{S} \bullet \mathsf{B})) \bullet \mathsf{C}))) \vdash \mathrm{S}}\mathsf{C}
}{\mathrm{DP} \bullet ((\mathrm{DP}\backslash \mathrm{S})/_2\mathrm{S} \bullet_2 (\boxed{\mathrm{S}/(\mathrm{DP}\backslash_3 \mathrm{S})} \bullet (\mathsf{I} \bullet (\mathrm{DP}\backslash \mathrm{S} \bullet \mathsf{B})))) \vdash \mathrm{S}}\mathsf{C}
}{\mathrm{DP} \bullet ((\mathrm{DP}\backslash \mathrm{S})/_2\mathrm{S} \bullet_2 ((\boxed{\mathrm{S}/(\mathrm{DP}\backslash_3 \mathrm{S})} \bullet \mathsf{I}) \bullet \mathrm{DP}\backslash \mathrm{S})) \vdash \mathrm{S}}\mathsf{B}
}{\mathrm{DP} \bullet ((\mathrm{DP}\backslash \mathrm{S})/_2\mathrm{S} \bullet_2 (\boxed{\mathrm{S}/(\mathrm{DP}\backslash_3 \mathrm{S})} \bullet \mathrm{DP}\backslash \mathrm{S})) \vdash \mathrm{S}}\mathsf{I}
}{\mathrm{Ann} \bullet (\mathrm{thought} \bullet_2 (\boxed{\mathrm{someone}} \bullet \mathrm{left})) \vdash \mathrm{S}}
$$

In a type logical grammar, a complete derivation begins with axiom instances and ends with the lexical types of the words of the sentence to be derived. Unmarked modes are 0. Reading from top to bottom, there is a box around the DP type that appears in embedded subject position. This position corresponds to the trace of Quantifier Raising. The progress of the boxes as the derivation proceeds shows how the combinators move the trace category step by step from trace position to its raised position.

In the second half of the derivation, the $\mathrm{S}/(\mathrm{DP}\backslash_3\mathrm{S})$ generalized quantifier type of *someone* is also boxed. This shows how the structural postulates move the quantifier category from its scope-taking position back into the position originally occupied by the trace, where it is pronounced.

The point at which the trace associated with *someone* escapes from the complement of *thought* is the highest C inference, marked in the diagram with a dagger†. This instantiation of the C inference has $i = 2$ and $j = 3$. Since $j \geq i$, this is an allowable instantiation of the inference rule.

The semantic interpretation of the derivation is $\mathbf{someone}(\lambda x.\mathbf{thought}(\mathbf{left}\,x)(\mathbf{ann}))$, as desired. This follows automatically via the Curry-Howard correspondence mapping type-logical derivations onto terms in the lambda calculus. Roughly, the *L* inferences correspond to function application, and the *R* inferences correspond to lambda abstraction; see, e.g., Moortgat 1997 for additional details.

If we replace *someone* with *everyone*, an attempt to give *everyone* wide scope creates an island violation. The derivation would begin exactly like the derivation just given, except that in order to eventually match the lexical type of *everyone* at the end of the derivation, the instantiation of the I postulate that launches the Quantifier Raising would have to introduce mode 1, instead of mode 3:

$$\dfrac{\dfrac{\dfrac{\dfrac{\vdots}{\mathrm{DP} \bullet ((\mathrm{DP}\backslash \mathrm{S})/_2\mathrm{S} \bullet_2 (\boxed{\mathrm{DP}} \bullet \mathrm{DP}\backslash \mathrm{S})) \vdash \mathrm{S}}}{\mathrm{DP} \bullet ((\mathrm{DP}\backslash \mathrm{S})/_2\mathrm{S} \bullet_2 ((\boxed{\mathrm{DP}} \bullet_1 \mathsf{I}) \bullet \mathrm{DP}\backslash \mathrm{S})) \vdash \mathrm{S}}\,\mathsf{I}}{\mathrm{DP} \bullet ((\mathrm{DP}\backslash \mathrm{S})/_2\mathrm{S} \bullet_2 (\boxed{\mathrm{DP}} \bullet_1 (\mathsf{I} \bullet (\mathrm{DP}\backslash \mathrm{S} \bullet \mathsf{B})))) \vdash \mathrm{S}}\,\mathsf{B}}{\mathrm{DP} \bullet (\boxed{\mathrm{DP}} \bullet_1 ((\mathrm{DP}\backslash \mathrm{S})/_2\mathrm{S} \bullet_2 ((\mathsf{I} \bullet (\mathrm{DP}\backslash \mathrm{S} \bullet \mathsf{B})) \bullet \mathsf{C}))) \vdash \mathrm{S}}\,\mathsf{C}^\dagger$$

But then instantiating the daggered C inference would require choosing $i = 2$ and $j = 1$. Since $j \not\geq i$, the daggered instance of C is not allowable, and we correctly predict that a scope island violation has occurred.

5.2 Previous formal accounts of scope islands

Rodman 1976 adapts Montague's 1973 fragment in a way that enforces relative clauses as a scope island. His strategy is to adjust the relative clause formation rule, as well as the Quantifying In rule, so that a quantifier cannot bind into a relative clause. However, it is far from clear how to translate Rodman's approach into a more modern theory, and I won't try here.

There are a number of accounts that make fine-grained distinctions among scope-takers, and then constrain where those scope-takers are allowed to take scope. Beghelli and Stowell 1997 is an especially prominent instance of this strategy. They articulate the left periphery of the clause into a sequence of nested functional categories, and then mark which classes of scope-takers are allowed to move into each of the functional projections. Their analysis makes a large number of welcome empirical predictions. However, nothing in their system limits scope-taking to a minimal clause, or to any other island context. We may ultimately need some analysis like Beghelli and

Stowell's to have a complete account of scope constraints, but we must look beyond their analysis for a general mechanism for enforcing scope islands.

Bernardi and Szabolcsi 2008 pursue a Beghelli and Stowell style approach within a formal system that provides a derivability relation both among the syntactic categories of the scope-takers. This establishes a partial order among scope-takers that enables Bernardi and Szabolcsi to state useful generalizations over classes of scope-takers. However, like Beghelli and Stowell, they also assume some unspecified mechanism that enforces scope islands.

Bernardi and Szabolci pursue their investigation in the setting of a type logical grammar, taking advantage of the unary modalities, Galois connectives, and logical derivability afforded by the type-logical approach. Unlike other well-known formal systems, the type logical tradition has long provided explicit mechanisms for constraining a variety of grammatical phenomena, from scrambling to associativity to scope taking. The first decades of this work is concisely summarized in Moortgat 1997. He explains how unary modalities can be deployed in a "lock and key" strategy: one modality (the lock) creates an island, and only elements marked with the dual modality (the key) can remove the lock to enable the completion of the derivation. In the usual deployment (e.g., Moortgat 1997, Bernardi 2002), scope takers are able to take scope freely within a region, but their scope-taking must be extinguished before the context that contains them (say, an embedded clause) can be placed under the key modality. Although this strategy can guarantee that scope-takers are restricted to their smallest containing clause (or other island), and although it is admirably flexible about creating islands on a per-predicate basis, it is not flexible about distinguishing among different scope-takers: in the usual configuration, either all scope-takers are trapped, or none.

Kokke 2016 supplements the lock and key strategy with special-purpose structural inference rules that allow specific scope-takers to escape from selected islands. For instance, he shows how to allow indefinites to scope out of embedded clauses at the same time that universals are trapped. In general, this allows for a system that creates islands that are both per-predicate and per-scope taker. Unlike Kokke 2016, the account here does not make use of any unary modalities.

Kiselyov and Shan 2014 develop a continuation hierarchy along the lines of Danvy and Filinsky's 1990 general strategy for building hierarchical layers of continuations. The idea is that a scope-taker is an expression that takes a portion of its context (one of its 'delimited continuations', in the jargon of work on continuations) as its argument. A scope island, then, is a context that bounds the scope-takers it contains. But if a scope-taker has a high enough type (higher in the continuation hierarchy) to take the context of its context as an argument, it can escape from the scope island. Kiselyov and Shan construct a hierarchy of levels of scope island and island escaping scope takers.

The system of Kiselyov and Shan has excellent theoretical and computational properties. In addition, it has plenty of fine-grained control: it establishes islands on a per-predicate, per-scope taker basis. There are a number of deep correspondences between their approach and the one developed here: both explicitly recognize continuations as a conceptual basis, and both make use of integers to index the strength of islands and island-escapers. But there are conceptual differences as well: for Kiselyov and Shan, quantifier scope ambiguity is due to (systematic, rule-governed) polysemy in the scope takers. In contrast, on the system here, each scope-taker has a single type and a single denotation. In addition, the Kiselyov and Shan grammar has some expressive limitations in the form in which they present it: only clauses can be islands, scope takers can take scope only over clauses, the result type must be a clause. In practical terms, this means that their system cannot address focus, expressives, or in-situ wh, all of which are compatible with the fragment described below. In addition, it is worth mentioning that although the Kiselyov and Shan grammar is easy to implement computationally and highly efficient, the types are too complex to perform derivations accurately by hand.

6 Conclusions

One moral of this paper is that it is hasty and unwise to base generalizations about scope restrictions on a small number of observations. Despite decades of careful observation—epitomized and collected in Szabolcsi 2010—we still have only a hazy idea what the full picture of scope islands looks like. That means we will need to find a way to collect large data sets of scope judgments.

Although it is useful to use QR as a general-purpose scoping mechanism to combine various different scope takers into a single comprehensive grammar, it is important to not lose track of the explanations for the individual scope restrictions, where explanations are available. For instance, on some theories of negative polarity, the reason that the scope of weak NPIs is trapped inside of their licensing domain is because that aligns (in most situations) with making a stronger (more informative) assertion.

In other cases, convincing explanations are much harder to find. Why is *think* but not *make sure* an island for *everyone*? Why do downward-monotonic operators resist undergoing inverse scope?

Perhaps it is best to think of grammars like the one sketched in the previous section as the descriptive target that our theories should aim to hit: once we get the explanations for each of the various semantic phenomena right (indefinites, negative polarity, focus, expressives, etc.), the patterns of the comprehensive grammar will fall out as a consequence of the component explanations. It is not obvious, however, on this federalist approach what will guarantee the subset constraint.

What about *syntactic* islands? It is easy to implement traditional ‘empty’ (i.e., silent) operator movement by adding a unit type. Allowing the unit to undergo Quantifier Raising (which would then more accurately be named ‘internal merge’) creates a movement trace. Displaced constituents can specify the strength of their movement trace, just as we saw above how a scope-taker can specify the strength of its QR trace. Then a syntactic island would be any constituent whose island strength was too great for the relevant movement trace to escape from.

Combining syntactic islands and scope islands within a single formal system would allow us to resume pursuit of the beautiful idea. Do syntactic islands obey the subset constraint? If so, is there a single unified ordering of island strength that characterizes both overt and covert island strength?

In any case, we can’t hope to arrive at a full explanatory picture unless we have the ability to describe the patterns that we find in an explicit and precise manner. The formal grammar proposed in this paper offers a step towards a fuller understanding.

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