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Sole sisters*

Elizabeth Coppock
Lund University

David Beaver
University of Texas at Austin

Abstract We propose a unified analysis of exclusives, taking into account NP- and VP-modifying *only* as well as *just* and the adjectival exclusives *mere*, *sole*, *only*, *single*, and *exclusive*. Using paraphrases with *at most* and *at least*, we argue that exclusives uniformly signify a presupposed lower bound and an ordinary content upper bound on the true alternative answers to the current question under discussion, thus extending Beaver and Clark 2008. We propose that exclusives vary along two parameters: (i) the ontological type of their arguments; (ii) constraints on the question under discussion. Due to variation in the type parameter, exclusives exhibit different scopes, leading to different NPI licensing properties. To formalize our analysis, we introduce a dynamic semantics that treats questions under discussion as part of the context and allows for binding into these questions.

Keywords: Exclusives, Negative polarity, Alternatives, Questions, Dynamic Semantics

1 Introduction

Focus-sensitive particles, most notably the exclusive adverb *only*, have brought out fundamental questions about compositionality and the relationship between semantics and pragmatics. Prior work on exclusives has tended to restrict attention to *only*; in this paper we consider a wider range of exclusives, including both NP- and VP-modifying uses of *only* and *just*, and the adjectival exclusives *mere*, *sole*, *only*, *single*, and *exclusive*. This paper, which builds on the analysis of *mere* in Coppock & Beaver 2010, supports the general approach of Beaver & Clark (2008), according to which exclusives can be analyzed in terms of a discourse model involving the Current Questions under discussion (CQ). We argue that exclusives uniformly signify a presupposed lower bound and an ordinary content upper bound on the true alternative answers to the CQ. We propose a lexical entry schema that expresses this common core and has two parameters allowing for variation among exclusives:

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(i) the type/category of the arguments that the exclusive takes (§3), and (ii) what we will refer to as a *discourse presupposition* constraining the CQ (§5).

We argue for at least two instantiations of the type parameter, one which corresponds to a single application of the Geach rule to Beaver and Clark's analysis of *only* (§3.2), and another which corresponds to two applications of it (§3.3). Differences in type lead to differences of scope, which predict – as we argue in detail in §4 – differences in where NPIs are licensed. Along with additional assumptions involving type-shifting, this fact allows us to account for a puzzle concerning NPI licensing by *just*, namely that when modifiying a subject noun phrase, it licenses NPIs in the VP only on a scalar reading (§3.4).

The CQ parameter, discussed in §5.1, captures constraints that exclusives place on the question under discussion. Formalizing this parameter leads into new theoretical territory, because it requires a framework in which it is possible to state presuppositional constraints on questions containing variables that are bound by a quantifier outscoping the exclusive. Our solution, presented briefly in §5.2, is a generalization of Beaver's (2001) dynamic semantics using a richer notion of context: meanings of sentences are context change potentials that operate on contexts containing not only information about what propositions hold, but also a CQ.

2 The common core: MAX and MIN

As Horn (2011) discusses, the late medieval scholars consider *only* one of the *exponibilia*: terms whose semantic analysis requires "unpacking" into multiple components. Since Horn 1969, modern semanticists have been debating the nature and status of those components, which can be referred to as the *positive contribution* and the *negative contribution* (van Rooij & Schulz 2007).

According to Beaver & Clark (2008), the positive contribution of *only* is expressed by the formula MIN(ϕ), and the negative contribution by MAX(ϕ), where ϕ is the prejacent. The positive contribution (MIN) is presupposed and the negative contribution (MAX) is part of the ordinary at-issue content. The MAX and MIN operators relate to the current Question Under Discussion (CQ; Roberts 1996),[1] which contains a set of alternative propositional answers, ranked by strength; MIN(ϕ) means that ϕ is a lower bound on the true answers to the CQ; MAX(ϕ) means that ϕ is an upper bound on them. We use the following formalization of MIN and MAX, where S represents an information state and $\geq$ represents the strength ranking, and p is a variable over propositions (functions from possible worlds to truth values),

1 We use 'CQ' rather than 'QUD' because for Roberts 'QUD' refers to an entire stack of questions; we are referring only to the single most burning question. Note also that the term 'QUD' was used in a different sense by Ginzburg (1996), as part of a theory of questions based on situation semantics.

and w is a variable over worlds:[2]

(1) $\text{MIN}_S(p) = \lambda w.\exists p' \in \text{CQ}_S[p'(w) \wedge p' \geq_S p]$

(2) $\text{MAX}_S(p) = \lambda w.\forall p' \in \text{CQ}_S[p'(w) \rightarrow p \geq_S p']$

Using the Heim and Kratzer notation for presuppositions, the meaning of *only* can then be captured by the following expression:[3]

(3) $\text{ONLY}_S = \lambda p.\lambda w : \text{MIN}_S(p)(w).\text{MAX}_S(p)(w)$

This is a *scalar* analysis because the alternatives are ranked in terms of strength. Other precedents for a scalar analysis include Krifka 1993, Bonomi & Casalegno 1993, van Rooij 2002, Beaver 2004, Klinedinst 2005, and Riester 2006. This contrasts with a more traditional analysis of *only* that could be labelled the *quantificational* analysis (e.g. Horn 1969, Groenendijk & Stokhof 1984, Rooth 1985, 1992, and Krifka 1992), under which the negative component rules out applications of the predicate corresponding to the non-focussed material in the prejacent to individuals other than the denotation of the focus.

We will argue shortly that the scalar analysis is more general in that it can be extended to a wider range of exclusives, but first let us demonstrate that, as has already been pointed out, it provides a unified treatment of two readings of *only*, which can be referred to as *non-scalar*, *quantificational,* or *exhaustive* on the one hand, and *scalar* or *rank-order* on the other. The most commonly discussed reading of *only* is the exhaustive one; this is the most salient reading of a sentence like (4):

(4) I **only** invited John and Mike.

It is exhaustive in the sense that the focus is taken to exhaust the relevant set of individuals (thus nobody other than John and Mike was invited). The exhaustive readings of *only* as in (4) can be obtained in the MAX/MIN framework by ranking the alternative answers as a boolean lattice so that, for example, answers like "I invited John and Mike and Frank" are stronger than answers like "I invited John and Mike". Under that type of ranking, what is presupposed according to the MAX/MIN analysis is that no answer weaker than or unranked with respect to "I invited John

2 On Beaver and Clark's definition of MIN, which is slightly different from the one in (1), answers lower-ranked than the prejacent are required to *false*, which means that the prejacent cannot be true when it entails lower-ranked answers. We do not want to commit to the assumption that the prejacent is always the lowest-ranked of the answers; the present formulation requires instead that something in the CQ at least as strong as p holds.

3 Note that here the presupposed content involving MIN constrains the discourse context, and specifically the CQ. However, the colon/dot notation is normally used to express presuppositions that are conditions that must hold in the world. We will address this is §5.2 by sketching how such a notion of presupposition may be made precise.

and Mike" is true. This rules out the weaker answers "I invited John", "I invited Frank", and answers that are unranked with respect to it such as "I invited Frank and Joe". The ordinary semantic content is that no answer stronger than it is true, so "I invited John and Mike and Frank" is ruled out. (It is also assumed that there is at least one true answer to the CQ, which gives the entailment that John and Mike were indeed invited.) Thus the scalar framework can yield exhaustive readings.

Scalar readings are, of course, naturally captured under a scalar analysis as well. Predicative sentences such as (5) provide a good source of scalar readings:

(5) The inventor was **only** an employee.

Example (5) does not mean that the inventor had no relevant properties other than being an employee, but rather that employeehood is the strongest property among those in question that he has. Thus if 'manager' is a stronger property in this context, then he didn't have that property. Another example of a scalar reading, discussed by Beaver and Clark, is the following, uttered as a response to a question about what philosophical celebrity signatures were obtained at a philosophy of language party:

(6) I **only** got a Soames.

This can be true even if the speaker also obtained a signature from the less-well-known philosopher Schmuckski, contrary to what a quantificational analysis of *only* predicts. In the scalar framework, this example can be accounted for by assuming that the answer "I got a Soames and a Schmuckski" is equivalent in rank to "I got a Soames."[4]

The at-issue component of the meaning of the exclusives *only*, *just* and *merely* according to the Beaver and Clark analysis, captured formally by MAX, can be loosely paraphrased in English with *at most*. In contrast, under the quantificational analysis of *only*, the negative component could be expressed with *nobody/nothing other than*. In the non-scalar case, both paraphrases for the negative, at-issue component yield sentences that are intuitively entailed by an *only* sentence:

(7) I invited **only/just** John. → I invited **nobody other than** John.

(8) I invited **only/just** John. → I invited **at most** John.

In the scalar case, however, while the *at most* sentence follows, the corresponding sentence with *nobody/nothing other than* does not:

4 In the case where the scale contains items that are equally ranked to but distinct from the prejacent, this analysis does not guarantee that the prejacent follows from a positive *only* sentence. This problem can be solved either by conjoining the prejacent to the at-issue component of the meaning of *only*, or by treating *only* as a type of intersective modifier.

(9) John is **only/just** a janitor. $\not\to$ John is **nothing other than** a janitor.

(10) John is **only/just** a janitor. → John is **at most** a janitor.

Under the scalar analysis, the presupposed, MIN component can be expressed in English with *at least*. On the quantificational analysis, the positive component can be expressed with the prejacent. Both the prejacent and *at least* sentences follow from positive exclusive sentences, scalar and non-scalar:

(11) I invited **only/just** John. → I invited John.

(12) I invited **only/just** John. → I invited **at least** John.

(13) John is **only/just** a janitor. → John is a janitor.

(14) John is **only/just** a janitor. → John is **at least** a janitor.

But under negation, the difference between analyses once again becomes significant. For a negated exclusive sentence, the *at least* sentence is always entailed, but the prejacent is not entailed in cases such as (17):

(15) I did**n't** invite **only/just** John. → I invited John.

(16) I did**n't** invite **only/just** John. → I invited **at least** John.

(17) John is**n't only/just** a janitor. $\not\to$ John is a janitor.

(18) John is**n't only/just** a janitor. → John is **at least** a janitor.

Although the prejacent is not reliably implied by the negation of a scalar exclusive predication (as also discussed by Beaver & Clark (2008)), the *at least* sentence is. This is illustrated by (18); *John isn't just a janitor* means that John's profession is at least as high on the scale of professions as 'janitor' (MIN), and not upper-bounded by 'janitor' (MAX). Thus *at most* and *at least* capture the positive and negative components that *only* contributes in both its scalar and non-scalar uses.

Not only can the scalar analysis tie together scalar and non-scalar uses of *only* and *just* (and as Beaver and Clark argue for *merely*) like those above, it can also be extended to other uses of exclusives, notably adjectival exclusives. Initial evidence for this – and a hint as to what form our analysis will take – comes from the fact that other exclusives yield entailments with *at least* and *at most* as well. For example, consider *mere*:

(19) He is a **mere** child → He is **at most** a child.

(20) He is a **mere** child → He is **at least** a child.

Sentences with *mere* are like sentences with scalar *only* in that the *nothing other than* inference does not follow:

(21) He is a **mere** child $\not\to$ He is **nothing other than** a child.

Likewise, a negated *mere* predication does not entail the 'prejacent' (to the extent that there can be said to be such a thing in *mere* sentences):

(22) He is not a **mere** child $\not\to$ He is a child.

But the *at least* sentence does follow:

(23) He is **not** a **mere** child → He is **at least** a child.

The premise of (23) means that the individual in question has a relevant property that is, in fact, higher up on the scale than 'child', e.g. 'adult'. A use of *mere* inside an argumental NP gives rise to *at most* and *at least* inferences as well (parentheses are used to indicate the non-at-issue status of the *at least* inference):

(24) γ The **mere** thought of food made me hungry. → The thing that is (**at least** and) **at most** the thought of food made me hungry.

Example (24) (in which the "γ" is used to indicate that the example is attested) can be paraphrased with *just*, giving rise to the same *at most* and *at least* inferences:

(25) **Just** the thought of food made me hungry.

This sentence has a non-scalar reading can that be paraphrased with *at most* and *at least* as well. The non-scalar reading is the most prominent reading of the corresponding sentence with *only*:

(26) **Only** the thought of food made me hungry.

On this reading, there is nothing other than the thought of food that made the speaker hungry. That reading implies both *At most the thought of food made me hungry*, and *At least the thought of food made me hungry*.

The adjectival exclusive *sole* also gives rise to *at least* and *at most* entailments. For example, (27) implies (28) and (29).

(27) He is the **sole** proprietor.

(28) **At least** $[\text{he}]_F$ is a proprietor.

(29) **At most** $[\text{he}]_F$ is a proprietor.

Complicating the picture, (27) has two distinct readings, and the definite article *the* functions differently in each case. What we term the *predicative* reading can be paraphrased as "Only he is a proprietor"; the other reading, which we call the *equative* reading, can be paraphrased "He is the same person as the sole proprietor". On the equative reading, the entire definite description is presupposed, as one would expect of a definite. So it is presupposed that there is an identifiable individual x such that at least and at most x is the proprietor, and it is at-issue that "he" is identical to x. On the predicative reading we see more typical exclusive behavior, insofar as (28) is presupposed and (29) is at-issue. To see this consider (30), the negation of (27). On its predicative reading, (28) follows but (29) does not.

(30) He is **not** the **sole** proprietor.

Our observations regarding (27) can be repeated with adjectival *only* in place of *sole*,[5] so adjectival *only* is also amenable to a MAX/MIN analysis. (This is reassuring given our analysis of its adverbial cousin.) *Exclusive*, on the other hand, gives rise to a different set of *at most* and *at least* inferences:

(31) He has **exclusive** rights. → **At most** he has rights.

(32) He has **exclusive** rights. → **At least** he has rights.

Thus a wide range of exclusives can be paraphrased with *at most* and *at least*, although there is variation in exactly what property the exclusive sets lower and upper bounds on. While we will only formally analyze a subset of that variation in this short paper, all the data considered supports the general claim that exclusives share a presupposed MIN component and an at-issue MAX component.

To capture the differences between exclusives, we propose two parameters along which they can vary. In the next section, we argue that one of these parameters is the ontological type of the arguments that exclusives take. Different instantiations of this *type parameter* lead to differences of scope, which can be used to explain certain puzzles related to NPI licensing.

3 The type parameter

3.1 A difference of scope

Beaver and Clark treat *only* as a sentence operator. This works reasonably well for both its NP-modifying use as in (33) and its VP-modifying use as in (34):

(33) **Only** John_F invited Mary.

(34) John **only** invited Mary_F.

5 Adjectival *only* is not completely equivalent to *sole*; unlike *sole*, *only* generally does not co-occur with the indefinite determiner (except in the fixed phrase *an only child*): *a(n) sole/*only owner*.

A sentence-operator analysis could also work for *mere* in a predicative sentence like (35), but it does not work for cases in which *mere* modifies the head of an argumental noun phrase, as in (36).

(35) The inventor is a **mere** employee.

(36) A **mere** child succeeded.

The alternatives that *mere* eliminates in this case do not include for example 'An adult succeeded', i.e. sentence-sized alternatives. If that were so, then (36) would imply that there was no adult who also succeeded, but there is no such implication. Rather, the alternatives are simple predications of x, where x is the discourse referent corresponding to the subject, like 'x is an adult'. An appropriate paraphrase for this sentence would be *Someone who is only a child succeeded*, with *only* inside a relative clause predicating the property of being a child. In other words, *mere* takes scope within the NP.

Further evidence that *mere* takes scope within the NP and not over the whole sentence is that it generally doesn't license NPIs in the VP, even though *only* does:

(37) **Only** a child said **anything**.

(38) * A **mere** child said **anything**.

We can explain these data under the assumption that *mere* does not take scope over the entire sentence, while *only* does, because these exclusives produce a Strawson Downward Entailing environment in von Fintel's (1999) sense. We justify the claim that NPIs are licensed in the scope of exclusives under our analysis in §4; please take our word for it for the time being.

Neither *sole* nor adjectival *only* licenses NPIs in the VP either:

(39) * The **sole**/**only** author got **any** royalties.

even though they do license NPIs in the noun phrase they modify:

(40) The *(**sole**/**only**) student who asked **any** questions got an A.

This suggests that in general, adjectival exclusives take scope only over the noun they modify, but there is at least one exception, which we will discuss below.[6]

3.2 Geached MAX/MIN

Our proposal for ordinary adjectival exclusives is as follows, where lower case subscripts on the variables indicate types (e stands for individual, w is the type of possible worlds, and p is short for $\langle w,t\rangle$):

6 *Mere* does not license NPIs in the noun it modifies: **He is a mere author of any children's books*. We believe that this is related to the fact that *only* doesn't license NPIs in its focus (see e.g. Beaver & Clark 2002 and Wagner 2005).

(41) $\text{G-ONLY}_S = \lambda P_{\langle e,p\rangle}.\lambda X_e.\text{ONLY}_S(P(X))$

We name this function G-ONLY because (41) is the result of applying the Geach rule to (3).[7] (The Geach rule converts a function f with type $\langle a,b\rangle$ into a function f' with type $\langle\langle c,a\rangle,\langle c,b\rangle\rangle$ of the form $\lambda R.\lambda x.f(R(x))$, where R has type $\langle c,a\rangle$. In the case of (41), a and b are p, and c is e, and f is ONLY_S.) Analyzing *mere* as G-ONLY gives us the following LF for *John is a mere employee*:

(42) $(\text{G-ONLY}_S(\text{EMPLOYEE}))(\text{J})$

where EMPLOYEE has type ep, and J has type e. This is, of course, equivalent to $\text{ONLY}_S(\text{EMPLOYEE}(\text{J}))$.

This treatment of *mere* will allow us to account for the fact that *mere* ordinarily does not license NPIs outside its syntactic scope. The LF for *A mere child succeeded* under our analysis is as follows:

(43) $\exists x[(\text{G-ONLY}_S(\text{CHILD}))(x) \wedge \text{SUCCEEDED}(x)]$

Notice that the VP, *succeeded*, is not in the scope of MAX/MIN. If the VP contains an NPI, as in (38), then the NPI will not be in the scope of *mere*.

The other adjectival exclusives we have discussed, *sole* and *only*, can also be analyzed as G-ONLY. Of course, *mere* and *sole* have hugely different meanings, and in §5 we will take care of this by including constraints on the CQ. But these constraints will not affect the scope of MAX and MIN, so what we have said about them so far suffices to explain the inability of *sole* and *only* to license NPIs in the VP, as illustrated in (40).

The function G-ONLY can also be used for VP-*only*, if we assume that the denotation of a VP is a property. Let us assume that INTRODUCE is a function of type $\langle e,\langle e,\langle e,p\rangle\rangle\rangle$, and the ordinary semantic value of *introduced Bill to Sue*$_F$ is $\lambda x.\text{INTRODUCE}(\text{B})(\text{S})(x)$. Then the LF of *John only introduced Bill to Sue* under this analysis will be:

(44) $\text{G-ONLY}_S(\lambda x.\text{INTRODUCE}(\text{B})(\text{S})(x))(\text{J})$

This *only* can also be deployed to represent the meaning of *John is only an employee*, giving (42) as an LF. This explains the intuitive equivalence between *John is a mere employee* and *John is only an employee*, and the fact that both presuppose *John is at least an employee* and entail *John is no more than an employee*.

3.3 Doubly-Geached MAX/MIN

NP-modifying *only* as in *Only John smokes* would not be amenable to an $\langle ep,ep\rangle$ analysis, but it need not be analyzed as the sentence operator ONLY either. To

7 Thanks to Walter Pedersen for pointing this out to us at SALT 2011.

analyze this case, we assume that *John* denotes a generalized quantifier, and that *only* corresponds to the Geach of our already-Geached formula (41), with *a* and *b* set to $\langle e, p \rangle = ep$, and *c* set to *e*.

(45) $\text{GG-ONLY}_S = \lambda P_{\langle ep,p \rangle}.\lambda X_{ep}.\text{ONLY}_S(P(X))$

Let LIFT be the function that converts an individual to the characteristic function of the set of properties it has: $\lambda j.\lambda P.P(j)$ (Partee 1986). With this, we propose the following LF for *Only John smokes*:

(46) $(\text{GG-ONLY}_S(\text{LIFT}(\text{J})))(\text{SMOKES})$

This is equivalent to: $\text{ONLY}_S((\text{LIFT}(\text{J}))(\text{SMOKES}))$, with the denotation of the VP *inside* the scope of ONLY. This predicts, correctly, that NP-modifying *only* licenses NPIs in the VP (even though the VP is outside its syntactic scope).

Independent support for the usefulness of GG-ONLY in the analysis of exclusives comes from uses of *mere* modifying quantifiers, as in (47). In such cases, *mere* licenses NPIs outside of its syntactic scope, in the VP (as discussed in Coppock & Beaver 2010).

(47) γ ?(A **mere**) 3% **ever** really make this business model work for them.

(48) γ I toiled for decades on a Wisconsin campus on which ?(a **mere**) 18 percent of the entering freshmen **ever** graduate.

We propose that in examples like (47) and (48), *mere*'s argument denotes a generalized quantifier, and *mere* has type $\langle\langle ep, p\rangle, \langle ep, p\rangle\rangle$. So the structure of, for example, *A mere 18 freshmen graduated* is:

(49) $(\text{GG-ONLY}_S(\text{EIGHTEEN}(\text{FRESHMEN})))(\text{GRADUATED})$

where EIGHTEEN is a function of type $\langle ep, \langle ep, p\rangle\rangle$, producing a function of type $\langle ep, p\rangle$ when applied to FRESHMEN (type *ep*). This is equivalent to:

(50) $\text{ONLY}_S((\text{EIGHTEEN}(\text{FRESHMEN}))(\text{GRADUATED}))$

with the VP *inside* the scope of ONLY. This accounts for the fact that NPIs are licensed in the VP by quantifier-modifying *mere*, even though they are outside its syntactic scope.

3.4 Scalar and non-scalar *just*

So far, there has been a tight correlation between the syntactic position of the exclusive and the way that it instantiates the type parameter: When the exclusive is a sister to a property-denoting expression such as a VP (VP-*only*) or a common noun (vanilla *mere*), we have G-ONLY, and when the exclusive precedes a determiner

(NP-*only*, quantifier-modifying *mere*), we have GG-ONLY. But the type parameter instantiation does not follow directly from syntax; evidence for this comes from *just*. Like *only*, *just* can modify NPs:

(51) **Just** the thought of him sends shivers down my spine.

If we replace *just* with *only*, a very different meaning pops out:

(52) **Only** the thought of him sends shivers down my spine.

Whereas (52) implies that nothing other than the thought of him sends the shivers (hence, something even more palpable, such as his presence or touch would not), (51) implies or suggests that his presence or touch would certainly send shivers if it did not produce an even greater effect. The primary reading of (51) can be paraphrased with *mere*:

(53) The **mere** thought of him sends shivers down my spine.

This is a *scalar* reading. *Just* can give rise to non-scalar readings like *only* in (52), but the scalar reading is more prominent. (*Only* can give rise to scalar readings too, but these are difficult to get.)

The presence of a scalar reading correlates with NPI licensing. On a non-scalar reading, *just* does not license NPIs:

(54) ?? **Just** a smile from him would make **any** difference.

The sentence strikes one as odd at first, because the scalar reading (on which *just a smile* can be paraphrased, "something so insignificant as a smile") does not license NPIs. The corresponding sentence with *only* is fine:

(55) **Only** a smile from him would make **any** difference.

And on the reading of (54) on which it is synonymous with (55), it is fine. In other words, (54) can only mean 'nothing other than a smile would make any difference', not 'something so insignificant as a smile would make a difference'.

An analysis of the scalar reading of NP-modifying *just* does not immediately present itself using the tools we have developed so far. The syntax suggests that *just* combines with the NP, and NPs are typically thought of as denoting either individuals or generalized quantifiers. If the NP is type *e*, then we cannot analyze *just* as G-ONLY or GG-ONLY. If we treat the NP as a generalized quantifier and analyze *just* as GG-ONLY, then we falsely predict that NPIs should be licensed in the VP, because the property denoted by the VP would be fed as an argument to the generalized quantifier, putting the VP in the scope of MAX/MIN.

We propose instead to analyze the NP as a property, obtained through type shifting, and to analyze *just* as G-ONLY. A sentence like "just the thought of him sends shivers down my spine" will be analyzed as "Something that is only the thought of

⟦the thought⟧	$= \iota x[\textsc{thought}(x)]$
LIFT	$= \lambda j.\lambda P.P(j)$
LIFT(⟦the thought⟧)	$= \lambda P[P(\iota x[\textsc{thought}(x)])]$
BE	$= \lambda Q.\lambda x.Q(\lambda y[y = x])$
BE(LIFT(⟦the thought⟧))	$= \lambda x.x = \iota x[\textsc{thought}(x)]$
⟦just⟧	$= \lambda P \lambda x[\textsc{only}_S(P(x))]$
⟦just⟧(BE(LIFT(⟦the thought⟧)))	$= \lambda x.\textsc{only}_S(x = \iota x[\textsc{thought}(x)])$
A	$= \lambda Q.\lambda P.\exists x[Q(x) \wedge P(x)]$
A(⟦just⟧(BE(LIFT(⟦the thought⟧))))	$= \lambda P.\exists x[\textsc{only}_S(x = \iota x[\textsc{thought}(x)]) \wedge P(x)]$

Figure 1 Analysis of *just the thought (of him)*.

him sends shivers down my spine". The property denoted by the NP is formed by taking Partee's (1986) BE – a function from generalized quantifiers to properties – and applying that to the generalized quantifier version of the NP formed through Partee's (1986) LIFT, as shown in Figure 1. The result is a property, which serves as the restrictor of an existential quantifier, so the LF of *just the thought of him sends shivers down my spine* is equivalent to:

(56) $\exists x[\textsc{only}_S(x = \iota x[\textsc{thought}(x)]) \wedge \textsc{sends-shivers}(x)]$

The alternatives that MAX relates to would be alternative characterizations of x: 'x is his presence', 'x is his touch', etc. This accounts for the possibility of paraphrasing *just the thought of him* as 'something so insignificant as the thought of him'.

This analysis also accounts for the fact that *just* does not license NPIs on its scalar reading: ONLY does not take scope over the VP in that case. On its non-scalar reading, *just* is just like *only*, taking the NP it modifies as a generalized quantifier, which takes the VP as an argument, so NPIs are licensed in that case.

3.5 Summary and discussion

So far, we have seen two instantiations of the following schema:

(57) $\lambda P_{\langle\tau,p\rangle}.\lambda X_\tau : \textsc{min}(P(X)).\textsc{max}(P(X))$

For property-modifying *mere*, other adjectival exclusives, VP-*only*, and the scalar reading of NP-*just*, τ is instantiated as e. For quantifier-modifying *mere*, NP-*only*, and the non-scalar reading of NP-*just*, τ is $\langle e,p\rangle$.

We can formulate the type parameter in at least two ways. Under one formulation, (57) is a general schema for exclusives, differing in how τ is instantiated. This is what we have claimed elsewhere (Coppock & Beaver 2010). Another perspective we could take is that the type parameter is the number of times that the Geach rule has applied to Beaver and Clark's original lexical entry. For the variant of *mere* that we find in e.g. (35), along with other adjectival exclusives, that number is 1; for quantifier-modifying *mere* and NP-*only*, that number is 2. (While we would not want to assume that the entry for *mere* is somehow derived from the Beaver and Clark entry for *only* through an online type-shifting operation, it seems reasonable that (45) is derived from (41) that way. This accords with the fact that *mere* is more frequent in its simpler use, and allows us to capture additional common constraints on the two uses without having to stipulate them twice.)

These two formulations make slightly different predictions about the range of possible exclusives. The former, according to which (57) is the schema that exclusives may instantiate, would be consistent with a wider range of possible instantiations of τ, but it would also require that exclusives always take two arguments, the first of which is of type $\langle \tau, p \rangle$. This rules out the pure, un-Geached Beaver and Clark exclusive ONLY, unless τ can be instantiated as a degenerate null type $\varnothing$, where $\langle \varnothing, \sigma \rangle = \sigma$, and the λ-term for the second argument can be pruned when its type is null. In any case, special extra assumptions would have to be made in order to allow a sentence operator exclusive under the former view. On the latter view, the pure, un-Geached Beaver and Clark exclusive constitutes the origin from which all other exclusives are derived, and in this sense represents the basic case.

So, are there any exclusives that should be analyzed with Beaver and Clark's original analysis, without any Geaching at all? Two candidates include the *only* that appears in *if only* constructions, and an *only* that can be paraphrased as *except*:

(58) If **only** I had done my homework, I could have gone dancing.

(59) I would have gone dancing, **only** I hadn't done my homework.

If only is arguably not compositional. One argument for this is that it cannot be used in non-optative contexts, as shown by the oddness of *#If only I had left a few minutes later, I would have missed my train*. (See also Rifkin 2000, Biezma 2011, and Grosz 2011.) The *only* that appears in (59) is not an exclusive, but an exceptive (evidence: it can be paraphrased by *except*). In the absence of more convincing examples, we are inclined to stick to the claim that (57) represents a general schema that exclusives instantiate. This opens up the question of what other instantiations of τ we may find.

4 NPI licensing with MAX/MIN

The arguments we have made above depend on the assumption that MAX/MIN creates an NPI licensing environment. In this section we will justify that claim, by showing that the environment it creates is Strawson Downward Entailing. A function f of type $\langle\sigma,\tau\rangle$ is Strawson-DE iff for all x,y of type σ such that $x \Rightarrow y$ (where the entailment operator is defined cross categorially) *and* $f(x)$ *is defined:* $f(y) \Rightarrow f(x)$ (von Fintel 1999). Von Fintel illustrates the Strawson-DE-ness connected with *only* with the following argument: If we assume that the presuppositions of *Only John ate kale* are satisfied – according to his analysis, that John ate kale – then *Only John ate vegetables* implies *Only John ate kale*. In this example, x corresponds KALE, y corresponds to VEGETABLES, and f corresponds to a function that, when applied to VEGETABLES, produces the meaning of *Only John ate vegetables*.

Applying Strawson Downward Entailment to our theory of *only* is not entirely trivial because for us the meaning of *only* depends on a context parameter that provides a question under discussion. Let $\text{ATE}(\text{J},\text{VEGETABLES})$ stand for the proposition that John ate vegetables (i.e., the characteristic function of the set of worlds in which John ate vegetables). The meaning of *Only John ate vegetables* under our theory is:

(60) $\text{ONLY}_S(\text{ATE}(\text{J},\text{VEGETABLES}))$
where the CQ given by S is “Who ate vegetables?”

The meaning of *Only John ate kale* relates to a different context S':

(61) $\text{ONLY}_{S'}(\text{ATE}(\text{J},\text{KALE}))$
where the CQ given by S' is “Who ate kale?”

Let us make this slightly more precise. Information states can be represented as tuples consisting of (i) a common ground (a set of worlds), (ii) a question under discussion (a set of answers, where each answer is a proposition), and (iii) a strength ranking over the possible answers to the question. Let us treat questions as sets of propositions, and notate the question “Who ate kale?” with $\ulcorner ?x[\text{ATE}(x,\text{KALE})]\urcorner$. This denotes the set of propositions that $\ulcorner\text{ATE}(x,\text{KALE})\urcorner$ denotes under assignments of x to different values. In general, if x is a variable of type α, then:[8]

(62) $[\![?x\phi]\!]_{M,g} = \bigcup_{d\in D_\alpha} [\![\phi]\!]_{M,g[x\mapsto d]}$

The ranking over these answers for the examples we are presently considering will be a boolean lattice corresponding to entailment, notated $\ulcorner\Rightarrow\urcorner$. If the common ground is G, then the information state S' for *Only John ate kale* is:

8 This is how the existential quantifier is defined in inquisitive semantics (Ciardelli 2010, Roelofsen 2011). The same syntax is given a different semantics in Groenendijk & Stokhof 1994: p. 37.

(63) $S' = \langle G, ?x[\text{ATE}(x, \text{KALE})], \Rightarrow \rangle$

In order to show that *only* produces a Strawson Downward Entailing environment under the MAX/MIN analysis, we must identify an f that produces (61) with S' instantiated as in (63) when applied to KALE. Here is such an f:

(64) $f = \lambda x[\text{ONLY}_{\langle G, ?y[\text{ATE}(y,x)], \Rightarrow \rangle}(\text{ATE}(\text{J}, x))]$

To decide whether f is SDE, we need to check whether $f(\text{VEGETABLES}) \Rightarrow f(\text{KALE})$, as long as $f(\text{KALE})$ is defined. Here is an informal argument that this is the case. $f(\text{VEGETABLES})$ is equivalent to:

(65) $\text{ONLY}_{\langle G, ?y[\text{ATE}(y, \text{VEGETABLES})], \Rightarrow \rangle}(\text{ATE}(\text{J}, \text{VEGETABLES}))$

This means, "no true answer to the question of who ate vegetables corresponds to a group containing John as well as others (and we assume that this group consists of at least John)." The definedness condition for $f(\text{KALE})$ is a MIN statement that can be paraphrased, "Any true answer to the question of who ate kale corresponds to a group that includes John," or more idiomatically, "At least John ate kale." From these two it follows that no true answer to the question of who ate kale corresponds to a group containing John as well as others, i.e. $\text{ONLY}_{S'}(\text{ATE}(\text{J}, \text{KALE}))$. Suppose this were not true; people other than John ate kale. Then there would be people other than John who ate vegetables, contradicting (65). So the argument is valid, at least when the answers are arranged as a boolean lattice.

Now consider for the sake of discussion (ignoring whether or not this reading is intuitively available) a scalar reading of *Only John ate vegetables*, where *only John* means something like 'no one more important or exciting than John'. The argument is still valid. Suppose that someone at least as exciting as John ate kale, i.e. $\text{MIN}_S(\text{ATE}(\text{J}, \text{KALE}))$, where the CQ/ranking in S can be glossed "How exciting of a person ate kale?". Suppose further that no one more exciting than John ate vegetables, i.e. $\text{MAX}_{S'}(\text{ATE}(\text{J}, \text{VEGETABLES}))$, where the CQ/ranking in S' can be glossed "How exciting of a person ate vegetables?" It follows that no one more exciting than John ate kale. Thus, *only* is Strawson-DE on the MAX/MIN analysis, even on scalar readings. In general, the scope of MAX/MIN is a Strawson Downward Entailing environment, so NPIs are predicted to be licensed inside it.

5 Constraints on the CQ and a dynamic account

5.1 Different exclusives, different CQs

Type differences of the kind discussed in §3 are not enough to explain all of the differences in meaning between exclusives. Consider *a mere child* and *a sole child*. In both cases, what is at-issue is $\text{MAX}(\text{CHILD}(x))$, and what is presupposed is

$\text{MIN}(\text{CHILD}(x))$. But the CQs are different. For *mere*, the CQ is a set of answers to the question "What properties does x have?", i.e.: $?P[P(x)]$.

To support intuitions as to difference between *mere* and *sole*, consider the fact that when *mere* is paraphrased with *only*, focus goes on the nominal property; *a mere child* is someone who is *only a child$_F$*. *A sole child* can be paraphrased with *only* as well, and here in a paraphrase the focus goes elsewhere: *someone such that only he$_F$ [among the relevant characters] is a child*. For a more idiomatic example, a *sole survivor* is a survivor such that nobody else (in the relevant group) is a survivor; a *sole proprietor* is a proprietor (of an establishment) such that nobody else is a proprietor (of that establishment). For this type of case, the CQ can be analyzed as, for example, the question "Who is a proprietor?", i.e. $?y[\text{PROPRIETOR}(y)]$, with alternative answers arranged via $\leq$ as a boolean lattice corresponding to the sum operation over individuals.

There are other uses of *sole* that describe a more general state of being unaccompanied by others:

(66) γ If you notice a sole female cyclist peddling down the Karakorum Highway (KKH) in May, don't be surprised.

This describes an individual who is unaccompanied by other travellers, not, for example, a female cyclist among several male cyclists. Such examples are common with *single*: A *single mother* is alone in her status as a *parent*, not as a mother. We could represent the CQ for such uses as "Who is a member of G?" where G is a salient group containing x. This is the type of CQ that seems appropriate for post-NP *alone*, as in *The thought of food* ***alone*** *made me hungry*, as well.

The CQ for *exclusive* is quite different. Someone who has *exclusive rights* to something, for example, has rights that nobody else has; an *exclusive offer* has limited availability. *Exclusive* seems to evoke the question of who is the possessor or owner of the object in question. These observations suggest that the range of CQ constraints that exclusives exhibit may be quite broad and we defer a fuller examination to future research.

5.2 Modelling the constraints: A dynamic account

Constraints on the nature of the CQ can be implemented as additional presuppositions about the question under discussion. These are what might be termed *discourse presuppositions*, in that they constrain the discourse context, but do not directly determine which propositions hold in the world external to the conversation, the stuff that is actually being talked about.

To express the discourse presuppositions introduced by *mere* and *sole*, we need a framework that allows us to require the CQ in the context to be a question that contains variables bound by a quantifier outscoping the exclusive. For example, consider again the LF for *A mere child succeeded* given in (43), repeated here for convenience:

(67) $\exists x[(\textsc{g-only}_S(\textsc{child}))(x) \wedge \textsc{succeeded}(x)]$

The CQ provided by the information state S will be $?P[P(x)]$, where x is bound by the existential quantifier. Such technology (i.e. questions with free variables) is independently needed for uses of *only* inside relative clauses, as in *man who only eats beans*$_F$. Ignoring complications relating to the bare plural and genericity, the latter might be represented as $\lambda x.\textsc{man}(x) \wedge \textsc{g-only}_S(\lambda y.\textsc{eats}(x)(y))(\textsc{beans})$, with x occurring free under the exclusive operator. In the short space remaining, we give a taste of the proper formulation.

Because Beaver's (2001) dynamic semantics deals successfully with quantified presuppositions, we propose to use this as starting point, and generalize it using a richer notion of context. We follow Beaver 2001 fairly closely, making use of a standard type theory with explicit quantification over worlds, namely Ty_3, as defined by Beaver (2001) on p. 165, an extension of Gallin's (1975) Ty_2 with a type for discourse markers (d). For Beaver (2001), the context is represented as an information state, which is a set of pairs consisting of a possible world and a variable assignment sequence à la Heim 1982. Information states thus have type $\iota = \langle w, \langle \sigma, t \rangle \rangle$, where $\sigma = \langle d, \langle e, t \rangle \rangle$ is the type of an assignment sequence.

Where we propose to depart from Beaver 2001 is in using a richer notion of context, consisting of (i) a common ground, i.e. an information state, (ii) a question (a set of answers, where each answer is an information state), and (iii) a strength ranking over the answers to the question. Under the assumption that the strength ranking does not rank answers other than those in the QUD, the QUD is recoverable from the strength ranking; it is its domain. Likewise, the common ground is recoverable from the QUD (cf. Jäger 1996). Therefore we represent the context simply as the strength ranking, and derive the QUD and the common ground from it. Given a context S, $\textsc{cq}.S$ is the domain of S, $\textsc{info}.S$ is the set of world-sequence pairs that are elements of every element of $\textsc{cq}.S$, and we use $\geq .S$ to refer to the strength ranking as such; $\geq .S = S$. If contexts are type θ, then CCPs are type $\langle \theta, \langle \theta, t \rangle \rangle$, i.e., they are relations between contexts.

Using these terms, Beaver and Clark's theory of *only* can be expressed as follows (we use the period to indicate function application, as in Beaver 2001):

(68) $\textsc{only} = \lambda C \lambda S \lambda S'[\textsc{min}.C.S.S \wedge \textsc{max}.C.S.S']$

This takes a CCP (C) and returns a CCP (a relation between S and S'), just as the original ONLY takes a proposition and returns a proposition. The presuppositional nature of the MIN component is expressed by requiring that the input state S is a reflexive point with respect to MIN and C. MAX as defined to take a CCP C and provide another CCP relating contexts S and S', where the CQ in S' is a subset of the CQ in S containing only information states that are as strong (according to the strength ranking in S) as any information state that results from updating with C. This is formalized as follows, where the curly brackets surround a binary predicate infixed between its two arguments:

(69) $\textsc{max} =$
$$\lambda C \lambda S \lambda S' [\textsc{cq}.S' = \lambda J[\textsc{cq}.S.J \wedge \ \forall S''[S\{C\}S'' \rightarrow J\{\geq .S\}(\textsc{info}.S'')]]]$$

MIN is analogous.

Now we are ready to express the additional constraint placed by *mere*, that the CQ is about what properties something has. We use a Geached version of (68):

(70) $$\textsc{g-only} = \lambda P \lambda D \lambda S \lambda S' [\textsc{min}.(P.D).S.S \wedge \textsc{max}.(P.D).S.S']$$

where D is a variable over discourse referents, and P is a variable over dynamic properties, i.e. functions from discourse referents to CCPs.

The lexical entry for *mere* further constrains G-ONLY by requiring a certain QUD thus:

(71) $$\textsc{mere} = \lambda P \lambda D \lambda S \lambda S' [\textsc{only}.(P.D).S.S' \wedge$$
$$\forall I[\textsc{cq}.S.I \rightarrow \exists C[C \in ?P'(P'.D) \ \wedge \ \exists S' \, C.S.S' \wedge I = \textsc{info}.S']]$$

This entry ensures that in *mere* ranges over a scale of properties. *Sole* is the same except that it requires the question to be a whodunit: $?D'(P.D')$.

6 Conclusion

Like the medievals, we have argued that the meaning of exclusives can be thought of in terms of separate components. However, our final analysis is not immediately recognizable as containing the exponibilia suggested by medieval scholars:

(72) $$\lambda \mathcal{P}_{\langle \tau, \Pi \rangle} \lambda \mathcal{X}_\tau \lambda S \lambda S' [\textsc{min}.(\mathcal{P}.\mathcal{X}).S.S \wedge \textsc{max}.(\mathcal{P}.\mathcal{X}).S.S'$$
$$\wedge \forall I[\textsc{cq}.S.I \rightarrow \exists C[C \in \Omega \wedge \ \exists S' \, C.S.S' \wedge I = \textsc{info}.S']]]$$

On our proposal, the parameters along which exclusives can vary are τ and Ω. The instantiations of τ that we have given evidence for are (i) d (for discourse markers; formerly e), and (ii) $\langle d, \Pi \rangle$, where $\Pi = \langle \theta, \langle \theta, t \rangle \rangle$ is the type of CCPs. (The latter corresponds to the doubly-Geached case.) The instantiations of Ω that we have seen are: (i) $?\mathcal{P}'(\mathcal{P}'.\mathcal{X})$ and (ii) $?\mathcal{X}'(\mathcal{P}.\mathcal{X}')$.

Of course, we cannot claim to have provided an empirical argument that this is the all-inclusive schema for exclusives. We have explored only a few exclusives in a single over-studied language. A great deal of work needs to be done to discover the extent to which this schema can be applied to exclusives in other languages, and the range of instantiations that it may have.

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Elizabeth Coppock
Centre for Languages and Literature
Lund University
Helgonabacken 12
Box 201, 221 00 Lund, Sweden
Elizabeth.Coppock@ling.lu.se

David Beaver
Department of Linguistics
The University of Texas at Austin
1 University Station B5100
Austin, TX 78712-0198, USA
dib@mail.utexas.edu