Minimal Sufficiency Readings in Conditionals

Elizabeth Coppock[*,†] and Anna Lindahl[*]
University of Gothenburg[*] and Swedish Collegium for Advanced Study[†]
eecoppock@gmail.com,annanlindahl@gmail.com

Abstract

We discuss minimal sufficiency readings of exclusives like *just*, as in *Just the thought of him sends shivers down my spine*, which does not mean the same thing as *Only the thought of him sends shivers down my spine*. We provide a set of diagnostics for identifying minimal sufficiency readings in conditionals and in simple clauses, and identify a generalization as to where the latter type appear: only in arguments that have a 'causer' thematic role. For this reason, we see minimal sufficiency readings in conditionals as basic, and provide an analysis of them building on Kratzer's notion of a modal base. The idea is that the exclusive particle signals an upper bound on the assumptions that have to be added to the modal base before the consequent follows.

1 Introduction

In this paper we are concerned with the contrast between the most prominent reading of (1) and the most prominent reading of (2).

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

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

Although *just* can be classified as an exclusive, it is not clearly behaving as one in (2). Coppock & Beaver (2014) suggest that what defines exclusives is that they can be paraphrased with *at least* and *at most* or *no more than*. For example:

(3) **Only** John smokes.
    a.   ≫ At least John smokes.   (≫ means presupposes)
    b.   ⇒ At most John smokes.   (⇒ means entails)

(4) John is **only/just** an assistant professor.
    a.   ≫ John is at least an assistant professor.
    b.   ⇒ John is at most an assistant professor.

(5) (Northwest was not liable because) it was a **mere** conduit for another's infringing conduct.
    a.   ≫ Northwest was at least a conduit.
    b.   ⇒ Northwest was at most a conduit.

(6) (She better be glad that) falsifying student records is the **only** thing she is being investigated for!

    a.   ≫ She is being investigated at least for falsifying student records.

    b.   ⇒ She is being investigated at most for falsifying student records.

(7)   (We cannot accept the premise that) it is the **sole** responsibility of those Member States.[1]

    a.   ≫ It is at least the responsibility of those Member States.

    b.   ⇒ It is at most the responsibility of those Member States.

(8)   (It just annoys me that) NBC has **exclusive** rights to televising the Olympics in the US.

    a.   ≫ At least NBC has rights to televising the Olympics in the US.

    b.   ⇒ At most NBC has rights to televising the Olympics in the US.

(9)   Deflation is not a **pure** monetary phenomenon. (It is the absence of real demand.)

    a.   ≫ Deflation is at least a monetary phenomenon.

    b.   ⇒ Deflation is not at most a monetary phenomenon.
        (Thus, deflation is more than just a monetary phenomenon.)

(10)   Treatment did not consist of chemotherapy **alone**.

    a.   ≫ Treatment consisted of at least chemotherapy.

    b.   ⇒ Treatment did not consist of at most chemotherapy.
        (Thus, treatment consisted of chemotherapy and something else.)

The use of *just* in (2) does not obviously have this property: It does imply that at least the thought of food made the speaker hungry, but it does not have the upper-bounding inference, that nothing more than the thought of food made the speaker hungry. In this respect (2) contrasts with (1), which does imply an upper bound on what made the speaker hungry. Adopting terminology from Grosz (2012), we call the phenomenon in (2) a 'minimal sufficiency reading'.

    Grosz (2012) applies the term 'minimal sufficiency reading' primarily to uses of exclusives (or exclusive-homonyms) in conditionals. According to Grosz (2012), the following sentence is ambiguous between an exclusive reading and a minimal sufficiency reading:

(11)   If just two people get on the boat, the boat will sink.

According to Grosz, this sentence has a reading that can be paraphrased, "If (at least) two persons (i.e. ≥2 people) get into the boat, which is not a lot, it will sink." Here again we

---

[1]A reviewer points out that this example is ambiguous out of context. It could mean either that those Member States have no other responsibilities, or that noone other than the Member States has responsibility for 'it'. In context, the intended interpretation is the latter; here is the full passage (from the EuroParl corpus): *Mr President, for us the problem of implementation should be a shared problem, and I personally cannot accept what Commissioner Barnier has said, when he simply washes his hands of the problems of four or five Member States. The problem is a shared one, the solution is a shared one. The fact that we have EUR 100 billion of outstanding commitments should be a problem for all the Community's institutions. We cannot accept the premise that it is the sole responsibility of those Member States. We certainly want to see action by all the institutions, including the Commission, and this Parliament in particular, as a matter of urgency.*

seem to have a non-exclusive reading of *just*, although it is a bit more difficult to articulate the contrast between an exclusive and a minimal sufficiency reading in this case.

There are two existing solutions to this puzzle in the literature. On what we will call the *Ambiguity hypothesis*, exclusives like *just* are typically ambiguous between a genuine exclusive reading and another reading on which they are truth-conditionally vacuous (Guerzoni 2003, Grosz 2012). On what we will call the *Scope hypothesis*, the scope of *just* is within the NP, and there is an implicit existential quantifier (Coppock & Beaver 2014). So (2) can be paraphrased:

(12) Something that is at most the thought of food (presupposing that it is at least the thought of food) made me hungry.

In this paper we argue that neither of these solutions is entirely satisfactory, and propose a third way. Our solution is based on the new observation that minimal sufficiency readings in non-conditional sentences like (2) are limited to noun phrases that have a 'causer' thematic role (henceforth the 'causativity generalization'). This suggests that causation is key to the analysis of minimal sufficiency readings, and that the cases involving conditionals most clearly reflect their logical structure. We therefore treat minimal sufficiency readings in conditionals as basic, and offer an analysis of such cases using Kratzer's notion of *modal base*, seen as a stock of assumptions. In a crude nutshell, the analysis is that minimal sufficiency readings say: "The only thing you need to add to your stock of assumptions is X, and then Y follows." Thus rather than postulating an ambiguity as under Grosz's account, we propose to treat words like *just* as exclusives, as under Coppock and Beaver's treatment of minimal sufficiency readings. But our proposal, unlike Coppock and Beaver's, accounts for the causativity generalization.

In §2, we offer a number of diagnostics that can be used to tease apart minimal sufficiency readings from ordinary exclusive readings, in order to circumscribe the phenomenon in question, and establish the causativity generalization. In §3, we review the theories of minimal sufficiency readings that have been offered. In §4, we sketch our own proposal and discuss its implications.

2 Data on minimal sufficiency readings

2.1 Conditionals

As mentioned above, the term 'minimal sufficiency reading' has been applied both to sentences like (2) and to conditionals like (11). According to Grosz (2012), (11) has two readings, which he glosses as follows:

(13) If just two people get on the boat, the boat will sink.

    a.   Exclusive reading (according to Grosz): "If no more than two persons (i.e. <3 people) get into the boat, it will sink."

    b.   Minimal sufficiency reading (according to Grosz): "If (at least) two persons (i.e. ≥2 people) get into the boat, which is not a lot, it will sink."

Note that the presuppositions are not represented in the gloss. Grosz assumes there to be an 'at least' presupposition on the exclusive reading, so it is presupposed that at least two

people get into the boat on that reading. Both readings come with a lowness presupposition, namely that two people getting on the boat is low on the scale of pragmatic strength. Restricting our attention to cases where the presuppositions of the exclusive reading are satisfied (i.e., where at least two people get on the boat, and that is not a lot), Grosz's glosses yield only a very subtle difference in truth conditions. Both require that the boat sinks if exactly two people get on the boat. But if it is considered possible that three people get on the boat, and it doesn't sink, then the sentence is false under the minimal sufficiency reading, but true on the exclusive reading. The state of affairs that the exclusive reading allows for and the minimal sufficiency reading rules out, in other words, is one where the boat would sink if two people got on, but not if three people got on – quite an implausible scenario to begin with. So the contrast is quite subtle.

Other examples allow us to see the distinction somewhat more clearly. Consider (14), a naturally-occurring web example.

(14)   He'd be too boring if he just used regular punches.

On the most prominent reading of this example, the exclusive has an effect on the truth conditions; if we remove the exclusive to produce *He'd be too boring if he used regular punches*, the sentence would imply that under any (normal) circumstance in which he used regular punches, regardless of what else he used, he would be too boring. Example (14) makes a weaker claim (in addition to presupposing that he uses regular punches): as long as he fails to combine his regular punches with other moves, he'll be too boring, but in principle he could use regular punches and not be too boring, as long as there was enough variety among his moves. So the presence of the exclusive particle has a truth-conditional effect.

Now consider the following variant, which has a minimal sufficiency reading:

(15)   He could win if he just used regular punches.

On the most prominent reading of this case, *just* has no detectable effect on the truth conditions; if we remove *just* to form *He could win if he used regular punches*, the resulting sentence conveys the same information. A closely related point is that (15) can be paraphrased by saying 'Him using regular punches is sufficient for him to win.' Example (14) cannot be paraphrased in the corresponding way: 'Him using regular punches is sufficient for him to be too boring' (even setting aside stylistic awkwardness).

The presence of a truth-conditional effect correlates with whether or not the sentence gives rise to a conditional perfection implicature.[2] Example (14) has a conditional perfection implicature: 'If he didn't just use regular punches (i.e., used other things as well), he wouldn't be too boring.' In contrast, (15) does not have the corresponding implicature, which would be 'If he didn't just use regular punches, he couldn't win.'

Related, on a minimal sufficiency reading, a conditional can felicitously be continued using *let alone* with a stronger alternative antecedent. For example ... *let alone if he used roundhouse kicks* is a felicitous continuation for (15) (*He could win if he just used regular punches, let alone if he used roundhouse kicks*), but not (14) (*??He would be too boring if he just used regular punches, let alone if he used roundhouse kicks*).

---

[2]*Conditional perfection* is the move from 'If A then B' to 'If not A then not B'.

Grosz (2012: 245) provides a nice pair of examples involving *just once* that can be used to illustrate these differences:

(16)   One good thing about pu-erh is that you can use the same cake over and over for multiple infusions. If you use it just once, you're wasting tea.

(17)   But it does work reasonably well, and if you use it just once, you've saved more than the purchase price.

Removing *just* would change the truth conditions of example (16), but not those of (17). And there is a conditional perfection implicature for (16) ('If you use it more than once, you're not wasting tea') but not for (17) ('If you use it more than once, you haven't saved more than the purchase price').

There also appears to be a correlation with emphasis and intonation. Compare the following two intonational variants:

(18)   a.   If he just *worked out* a little, he'd be hot.
       b.   ??If he *just* worked out *a little*, he'd be hot.

The emphasis pattern in (18a), consistent with broad focus on the whole sentence, is natural on a minimal sufficiency reading, where it is implied he doesn't work out at all, and would be even hotter if he worked out a lot. Focal emphasis on *a little* plus emphasis on the exclusive more naturally reads to a funny exclusive interpretation where he works out too much, and should work out less to become hotter – funny because normally the more one works out the hotter one becomes. (This is dependent on intonation as well as emphasis; with the right tone of exasperation, it is possible to get a minimal sufficiency reading with emphasis on *just* and *a little*.) A more natural consequent for the exclusive reading is *he wouldn't be as hot*. Then emphasis on *worked out* becomes relatively odd:

(19)   a.   ??If he just *worked out* a little, he wouldn't be as hot.
       b.   If he *just* worked out *a little*, he wouldn't be as hot.

In Swedish, the difference is reflected in word order. The Swedish word *bara* 'only' can be found either in adverbial position or in the position of a conditional subordinator (Wijk-Andersson 1991, Rosenkvist 2014). The conditional subordinator can be used in cases like (15) and (17) but not (14) and (16).

(20)   a.   Om du **bara** använder den en gång så har du redan tjänat in pengarna.
             'If you only use it once, you've already gotten your money's worth.'
       b.   Om du **bara** använder den en gång så är det inte värt pengarna.
             'If you only use it once, it's not worth the money.'

(21)   a.   **Bara** du använder den en gång så har du redan tjänat in pengarna.
             'If you only use it once, you've already gotten your money's worth.'
       b.   ??**Bara** du använder den en gång så är det inte värt pengarna.
             'If you only use it once, you've already gotten your money's worth.'

We may summarize the situation as follows: On minimal sufficiency readings of exclusives in conditionals, there is no truth-conditional effect, no conditional perfection implicature, and conditional subordinator *bara* can be used in Swedish. These properties do not hold for ordinary exclusive readings.

2.2 Simple transitive sentences

Now let us consider minimal sufficiency readings in simple transitive sentences, such as the variant of the following sentence with *just*:

(22)   Just/??Only the thought of him sends shivers down my spine.

The variant with *only* tends strongly toward an exclusive reading, which we can identify on the basis of a number of features.

First, on the minimal sufficiency reading, the sentence has the same truth conditions with or without the exclusive:

(23)   The thought of him sends shivers down my spine.
       (implies *just* version but not *only* version)

Second, the version with *just* can be paraphrased with *sufficient*:

(24)   The thought of him is sufficient to send shivers down my spine.
       (good paraphrase of *just*-version, not *only*-version)

Third, the version with *only* on the other hand can be paraphrased with *necessary* and *nothing other than* or *the only thing*:

(25)   The thought of him is necessary to send shivers down my spine.
       (good paraphrase of *only*-version, not *just*-version)

(26)   Nothing other than the thought of him sends shivers down my spine.
       (good paraphrase of *only* version but not *just* version)

(27)   The only thing that sends shivers down my spine is the thought of him.
       (follows from *only* version but not *just* version)

Fourth, as Coppock & Beaver (2014) point out, the minimal sufficiency reading can be paraphrased with an indefinite and *only*:

(28)   Something that is only the thought of him sends shivers down my spine.
       (good paraphrase of *just* version, not *only*-version)

Fifth, it can also be paraphrased with *mere*.

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

Sixth, *let alone* can be combined only with a minimal sufficiency reading, hence combines more easily with *just*:

(30)   Just/#Only the thought of him sends shivers down my spine, let alone the sight of him.

Seventh, and finally, notice that NPIs are licensed by the *only* version and not the *just* version:

(31)   ??Just/Only a smile from him would make any difference.

These are all features that set exclusive readings apart from minimal sufficiency readings. In the following, we will focus on the 'and nothing/nobody else' diagnostic.

Now let us observe that minimal sufficiency readings are not always available in non-conditional sentences. For example, when modifying the object of a perception verb, *just* does not give rise to minimal sufficiency readings:

(32) I **saw** *just the beginning*.   [no MSR]
      → I saw nothing else.

Here are some additional cases in which a noun phrase in an object position fails to give rise to a minimal sufficiency reading:

(33) I **had** *just the thought of him*.   [no MSR]
      → I had nothing else.

(34) I **gave** *just the book* to John.   [no MSR]
      → I gave nothing else to him.

(35) I **told** John *just the beginning of the story*.   [no MSR]
      → I told him nothing else.

In these cases the thematic role that the noun phrase plays in the sentence is not a causer, but rather a theme or undergoer.

The stimulus argument of an experiencer verb, on the other hand, can give rise to a minimal sufficiency reading:

(36) She **resents** *just the fact that she exists*   [MSR]
      ↛ She resents nothing else.

(37) I **fear** *just the idea of such memories coming back to haunt me* at times.   [MSR]
      ↛ I fear nothing else.

So minimal sufficiency readings are possible with grammatical objects.

Unaccusative subjects, on the other hand, appear not to be associated with minimal sufficiency readings:

(38) *Just the ship* **arrived**.   [no MSR]
      → Nothing else arrived.

(39) *Just the window* **broke**.   [no MSR]
      → Nothing else broke.

A causer argument can have a minimal sufficiency reading:

(40) *Just the rock* **broke** the window.   [MSR]
      ↛ Nothing else broke the window.

Agentive subjects, however, seem to have only exclusive readings:

(41) *Just the boy* **broke** the window.   [no MSR]
      → Nobody else broke the window.

Taken together, these observations lead us to the following generalization:

(42) **Causativity generalization:** NP-modifying *just* has a minimal sufficiency reading within a single clause when the NP plays a non-agentive causer role.

This generalization forms the basis of our analytical strategy to treat minimal sufficiency readings in conditionals as the more basic case, as the underlying causal structure is explicit there.

3 Theories

3.1 Background: Beaver & Clark

Let us now review the two theories of minimal sufficiency readings that have been proposed, Grosz (2012) and Coppock & Beaver (2014). Building on Beaver & Clark 2008, both build on the background assumption that exclusives like *only* and *just* (on the exclusive reading) depend for their meaning on the Question Under Discussion, an implicit or explicit question (formalized as the set of its answers) which is congruent with the focus alternatives of a sentence.[3] Both theories of minimal sufficiency readings furthermore assume that ordinary exclusives come with an *at least* presupposition, which says that some answer to the QUD at least as strong as the prejacent holds, and make a typically at-issue *at most* contribution, which says that no answer to the QUD that is stronger than the prejacent is true.

Here, we make this precise using a logical representation language to represent the meanings of the natural language expressions. In order to specify the semantics for this logic, let us stipulate that expressions of the logic will be interpreted with respect to a model M, a world w, an assignment function g, and a state s, which determines a pragmatic strength relation $\geq_s$ over propositions in the QUD $\hat{s}$. We will have QUD as a constant in our language, representing a predicate that holds of a proposition-denoting expression π in a given state s if π's denotation is among the answers to the QUD in state s.

(43) $[\![\mathrm{QUD}(\pi)]\!]^{M,g,w,s} = \mathrm{T}$ if $[\![\pi]\!]^{M,g,w,s} \in \hat{s}$ and F otherwise.

Following a notational convention from Geurts & Nouwen (2007), we will use a triangle in our logic to represent the pragmatic strength relation:

(44) $[\![\pi_1 \trianglerighteq \pi_2]\!]^{M,g,w,s} = \mathrm{T}$ if $\langle [\![\pi_1]\!]^{M,g,w,s}, [\![\pi_2]\!]^{M,g,w,s} \rangle \in \geq_s$, and F otherwise.

The 'at least' component of the meaning of *only* is represented with the constant MIN, defined as in (45) (modified according to Coppock & Beaver 2014), and the 'at most' component is represented with the constant MAX, defined as in (46).

(45) $\mathrm{MIN}(p) \equiv \lambda w \,.\, \exists p'[\mathrm{QUD}(p) \wedge p'(w) \wedge p' \trianglerighteq p]$
'There is a true answer to the QUD that is at least as strong as p'

(46) $\mathrm{MAX}(p) \equiv \lambda w \,.\, \forall p'[[\mathrm{QUD}(p') \wedge p'(w)] \rightarrow p \trianglerighteq p']$
'There is no true answer to the QUD stronger than p'

---

[3]For example, *John_F laughed* is congruent to the question *Who laughed?* where as *John laughed_F* is congruent to the question *What did John do?*.

The MIN component is presupposed by *only*, and the MAX component is part of its at-issue meaning. To make this distinction, we assume furthermore three truth values: T (true), F (false), or $\#$ (undefined). We use Beaver & Krahmer's (2001) ∂ operator to handle presupposition:

(47) $[\![\partial[\phi]]\!]^{M,g,w,s}$ = T if $[\![\phi]\!]^{M,g,w,s}$ = T. Otherwise $[\![\partial[\phi]]\!]^{M,g,w,s}$ = $\#$.

The Beaver and Clark lexical entry for *only* can then be represented as follows, where the $\rightsquigarrow$ arrow signals a translation from natural language to our formal representation language:

(48) Beaver and Clark lexical entry for *only*
      $only \rightsquigarrow \lambda p \lambda w . [\partial[\text{MIN}(p)(w)] \wedge \text{MAX}(p)(w)]$

Grosz's lexical entry for exclusive-*only* specifies an additional 'lowness' presupposition, that the prejacent is low on the scale of pragmatic strength. We can represent this as follows:

(49) Grosz's lexical entry for *only*
      $only \rightsquigarrow \lambda p \lambda w . [\partial[\text{MIN}(p)(w) \wedge \text{LOW}(p)] \wedge \text{MAX}(p)(w)]$

Following Grosz (2012), we might interpret $\text{LOW}(p)$ to mean that most answers to the QUD are higher than p. We will not formalize this here.

Coppock & Beaver (2014) adopt Beaver & Clark's (2008) analysis of *only* (modulo the definition of MIN), so as far as ordinary exclusive *only* goes, the lowness presupposition is the only place where the two analyses differ, and this is not a substantive difference; the lowness presupposition was not omitted by Coppock and Beaver for any particular reason. Where the two analyses differ is in how minimal sufficiency readings are treated. Coppock and Beaver aim to unify minimal sufficiency readings with exclusive readings, invoking (48) in both cases. Grosz on the other hand posits an ambiguity for words that allow for minimal sufficiency readings, with a second *only* that retains the lowness presupposition but is otherwise vacuous.

3.2 Grosz's theory

According to Grosz (2012), following Guerzoni (2003: ch. 4), exclusives sometimes have an additional reading, which Grosz calls $only_2$, defined as follows:

(50) $only_2 \rightsquigarrow \lambda p \lambda w . [\partial[\text{LOW}(p)] \wedge p(w)]$

So for *just the thought of him sends shivers down my spine*:

- It is presupposed that 'the thought of him sends shivers down my spine' is low on the scale of answers to the QUD
- It is entailed that the thought of him sends shivers down my spine.

There is no 'at most' component in this case. (When *just* is used as an ordinary exclusive, it is interpreted as (48), with an 'at most' component as well. Grosz calls this an $only_1$ reading.)

Minimal sufficiency readings and optative uses of exclusives as in (51) both involve $only_2$ according to Grosz.

(51) Oh, if only he knew!

This assumption is supported by a cross-linguistic correlation between use of exclusives in optatives and minimal sufficiency reading in conditionals. For example, *solo* in Spanish supposedly not allow a minimal sufficiency reading and does not appear in optatives:

(52) a. Si **solo** dos personas se montan en esa barca, se hundira
          'If only two people get on that boat, it will sink.'
          (How do we know that this is not a minimal sufficiency reading?)

      b. Si ⟨*solo⟩ Juna hubiera ⟨**al menos**⟩ escuchado a María!
          'If only John had listened to Maria!'

Brazilian Portuguese *só* and *apenas*, Greek *mono*, Catalan *només* reportedly have the same property. All these languages use their equivalent of 'at least' in optatives. Conversely, German *bloß*, Italian *solo* and *solamente*, Lebanese Arabic *bass*, Czech *jen*, Polish *tyklko*, Serbian *samo*, and Norwegian *bara* reportedly allow minimal sufficiency readings and occur in optatives. The ability to account for this generalization is a virtue of Grosz's theory, but it also comes with certain difficulties; for example, the generalization is violated by English *only*, which is used in optatives but not in minimal sufficiency readings, and English is not alone, as Grosz admits. (We offer no theory of optatives here.)

However, Grosz's theory does not explain the limited distribution of minimal sufficiency readings, i.e., the causativity generalization. Nothing prevents $only_2$ from modifying non-causer noun phrases. For example, take *I saw just the beginning.* Why doesn't this have an $only_2$ reading?

3.3 Coppock & Beaver's theory

Coppock & Beaver make a distinction between two kinds of readings that exclusives can have, depending on the type of scale that lies in the background.

- *Complement exclusion readings.* These can be paraphrased with *and nothing/nobody else.* For example, *Only John smokes* implies *John smokes and nobody else smokes.*
- *Rank-order readings.* These involve a scale where higher-ranked alternatives do not entail lower-ranked alternatives and cannot be paraphrased with *and nothing/nobody else.* For example, *John is only an assistant professor* does not mean that John is an assistant professor *and nothing else*; it means that he is an assistant professor *and nothing more*, i.e., nothing higher on the scale. Here, higher-ranked alternatives such as 'John is a full professor' do not entail lower ranked alternatives such as 'John is an assistant professor'.

Some exclusives allow only complement-exclusion readings, as one can see in the following paradigm, where the frame requires a rank-order reading.

(53) a. She is a mere assistant professor.

      b. She is just an assistant professor.

      c. She is merely an assistant professor.

      d. She is only an assistant professor.

      e. #She is exclusively an assistant professor.

      f. #She is purely an assistant professor.

33

      g.   #She is simply an assistant professor.

      h.   #She is solely an assistant professor.

And there is a correlation between exclusives that allow minimal sufficiency readings and those that allow rank-order readings, as we can see in the following paradigm.

(54)   a.   The mere thought of food makes me hungry.

      b.   Just the thought of food makes me hungry.

      c.   ?Merely the thought of food makes me hungry.

      d.   ?Only the thought of food makes me hungry.

      e.   #Exclusively the thought of food makes me hungry.

      f.   #Purely the thought of food makes me hungry.

      g.   #Simply the thought of food makes me hungry.

      h.   #Solely the thought of food makes me hungry.

Note that the correlation is not perfect; *only* for example allows rank-order readings (in positive sentences[4]) but resists minimal sufficiency readings.

According to Coppock & Beaver (2014), minimal sufficiency readings as in (54) are simply rank-order readings with NP-internal scope. Let us adopt the following abbreviation for the translation of *only* according to the Beaver and Clark analysis:

(55)   ONLY $\equiv \lambda p \lambda w \,.\, [\partial[\text{MIN}(p)(w)] \wedge \text{MAX}(p)(w)]$

A minimal sufficiency reading gets the following formal representation, which is achieved through a sequence of type-shifting operations:

(56)   *Just the thought of him$_z$ sends shivers down my spine* $\rightsquigarrow$
$\exists x[\text{ONLY}(x = \iota y \,.\, \text{THOUGHT-OF}(y, z)) \wedge \text{SENDS-SHIVERS}(x)]$

where the alternatives are of the form 'x is the sight of him$_z$', etc. In other words, *just the thought of him* means 'something so insignificant as the thought of him'. (See the appendix for the details of the derivation.)

4   Toward a proposal

Both of the foregoing approaches have disadvantages. One disadvantage of Grosz's approach is that minimal sufficiency readings and exclusive readings are derived via two distinct lexical entries; ideally we would unify them. A disadvantage of Coppock & Beaver's approach is that it is unclear what motivates the sequence of type-shifts that is thought to be involved, if type-shifting is a last resort. A disadvantage of both approaches is that they overgenerate, failing to account for the causativity generalization.

The causativity generalization suggests that minimal sufficiency readings in (causal) conditionals are basic, and that in NP-modifying cases the causal structure is playing an important role. In this section, we sketch a treatment of minimal sufficiency readings that

---

[4]Negated *only* does not appear to do so, as Larry Horn has observed (e.g. Horn 2011); see Coppock & Beaver (2014) for discussion of this point.

starts with the analysis of conditionals. The idea is that the exclusives that figure in minimal sufficiency readings retain their exclusive nature, but operate at an abstract level, where the question under discussion is what assumptions one needs to make.

The idea builds on Stalnaker's (1968: 102) characterization of how conditionals work:

> First, add the antecedent (hypothetically) to your stock of beliefs; second, make whatever adjustments are required to maintain consistency (without modifying the hypothetical belief in the antecedent); finally, consider whether or not the consequent is the true.

In these terms, minimal sufficiency readings (in conditionals) say, "You **only** need to add the antecedent to your stock of beliefs to make the consequent follow." Or: "If you add the antecedent **and no more** to your stock of beliefs, the consequent follows." Some examples:

- If you assume **only** that I think of him (i.e., you assume that I think of him, and you assume **nothing more**), you will derive the consequence that he sends shivers down my spine.
- If you assume **only** that he works out a little, you will derive the consequence that he is hot.

This view, like that of Coppock & Beaver (2014), aims for a unified and genuinely exclusive treatment of minimal sufficiency readings. They turn out to be truth-conditionally vacuous, as under Grosz's treatment, but this strategy allows us to capture their limited distribution.

To formalize our analysis, we build on Kratzer's (1983) analysis of conditionals, which is based on the analysis of modals. Modals are interpreted with respect to a *modal base* and an *ordering source*.

- A modal base is a function from worlds to sets of propositions. It assigns to each world a set of *facts* that are known or assumed to be the case at that world.
- An ordering source is also a function from worlds to sets of propositions. It assigns to each world a set of *ideals* that hold at that world, derived for example from what is legal, moral, or normal. Here, the purpose of the ordering source is to limit the scope of the claim to normal circumstances (so it does not play a starring role in the story).
- "if Φ then Ψ" is interpreted as "must Ψ", where, if f is the modal base for the antecedent, then f_p^+ is the modal base for "must Ψ" and p is the proposition expressed by the antecedent Φ.
- f_p^+ is that function from possible worlds to sets of propositions such that for any world w, $f_p^+(w) = f(w) \cup \{p\}$. Let us assume that this notation is present in the formal representation language as well.

To formalize "must Ψ", we adopt the following. Let Ψ be an expression of type $\langle s, t \rangle$, ω a variable over possible worlds, β a variable over modal bases, and γ a variable over ordering sources. Then:[5]

(57) $[\![\Box_{\omega,\beta,\gamma}\Psi]\!] = \text{T}$ iff $[\![\Psi]\!](w') = \text{T}$ for every $w' \in O([\![\omega]\!], [\![\beta]\!], [\![\gamma]\!])$
   where $O(w, f, g) = \{u \in f(w) \mid \neg\exists v \in f(w) : u <_{g(w)} v\}$
   and $u <_{g(w)} v$ iff the set of propositions in $g(w)$ that are true in v is a subset of the propositions in $g(w)$ that are true in u.

---

[5]Formalization inspired by Condoravdi & Lauer (2014).

The logical representation for *If he just worked out a little, he'd be hot* is then:

(58) $\lambda w \exists A[\partial[\text{MIN}(A = \{\text{WO}\})(w)] \land \text{MAX}(A = \{\text{WO}\})(w) \land \Box_{w,f_A^+,g}[\text{HOT}]]$

where WO means 'He works out a little' and HOT means 'He'd be hot'.

We assume that the QUD is 'What is A?', i.e., 'What do we add to the modal base?' The answers include different sets of assumptions. If X is a subset of Y, then $A = Y$ is a stronger answer than $A = X$. So the sentence says: 'if we assume no more than that he works out a little (presupposing that we assume at least this), it follows that he would be hot'.

Assuming that causal statements can be explicated similarly to conditionals, the same kind of analysis can apply. In causal non-conditional sentences like *Just the thought of him sends shivers down my spine*, we may assume that there is a relevant modal base which gets augmented by the assumption that the causal factor is instantiated. For example, the modal base may be augmented by the assumption that the speaker has the thought of him. What the exclusive signals is that more need not to be added in order for the consequent to follow. Minimal sufficiency readings are not predicted to exist outside of causal environments under this view.

It is also predicted that the exclusive should not affect the truth conditions under a minimal sufficiency reading, and yield the kinds of paraphrases with *sufficient* that we saw above. Insofar as the truth conditions are not affected, we also explains the lack of NPI-licensing by exclusives in non-conditional sentences on minimal sufficiency readings. This approach also explains the lack of a conditional perfection implicature with *more than* (e.g. if he worked out more than a little, he wouldn't be hot). This approach also predicts that minimal sufficiency readings should arise with diverse exclusives, not being limited to lexical items that happen to have lost their 'at most' component. We should even find them with expressions like *no more than*, which consists entirely of an 'at most' component. This prediction is borne out.

(59) Everyone feels how his evil inclination ceases to exist even if he **no more than** focuses his mind and thought strongly upon God.

Why minimal sufficiency readings are limited to certain exclusives is one of the many questions we must leave for further research.

5 Summary

We have argued for and sketched an approach to minimal sufficiency readings that starts with the case of conditionals, a move justified on the grounds of the 'causativity generalization' we have identified: that minimal sufficiency readings in non-conditional sentences are found only in connection with causer roles. The idea behind the analysis is that the exclusive signals an upper bound on what assumptions need to be added to the modal base in order for the consequent to follow. This approach can then be extended to non-conditional causative sentences insofar as they have a similar underlying structure to conditionals. We have thus outlined a unified analysis of exclusives that can account for the causativity generalization.

Appendix: Coppock & Beaver's (2014) analysis of MSRs

Coppock & Beaver (2014) analyze NP-modifying *just* as follows. First, they use a meaning for *just* that is the same as Beaver & Clark's (2008) entry for *only* except that it has the semantic type of a property modifier. Among the translations for *only* is G-ONLY ('Geached ONLY'), which is an abbreviation in the formal language defined as follows:

(60) G-ONLY $\equiv \lambda P_{\langle e,p \rangle} . \lambda x . \text{ONLY}(P(x))$

It is called G-ONLY because it is the result of applying the Geach rule to (48).[6]

For *Just the thought of him sends shivers down my spine*, the analysis can be paraphrased:

(61) Something that is only the thought of him sends shivers down my spine.

Coppock & Beaver (2014) obtain this by analyzing the NP as a property, obtained through type shifting, and analyzing *just* as G-ONLY.

The property denoted by the NP is formed by starting with a Fregean analysis of *the thought of him$_z$*:

(62) *the thought of him$_z$* $\rightsquigarrow \lambda x . \iota y . \text{THOUGHT-OF}(y, z)$

Then it is coverted to a generalized quantifier via Partee's (1986) LIFT as defined in (63), yielding (64):

(63) LIFT $\equiv \lambda j . \lambda P . P(j)$

(64) *the thought* $\rightsquigarrow \lambda P . P(\iota y . \text{THOUGHT-OF}(y, z)))$

Then Partee's (1986) BE, defined in (65), applies, yielding (66).

(65) BE $\equiv \lambda Q . \lambda x . Q(\lambda y . y = x)$

(66) *the thought of him$_z$* $\rightsquigarrow \lambda x . x = \iota y . \text{THOUGHT-OF}(y, z)$

It is to this property that G-ONLY applies, yielding:

(67) *just the thought* $\rightsquigarrow \lambda x . \text{ONLY}(x = \iota y . \text{THOUGHT-OF}(y, z))$

Finally, existential closure, defined in (68), applies, yielding (69):

(68) EX $\equiv \lambda Q . \lambda P . \exists x [Q(x) \wedge P(x)]$

(69) *just the thought of him* $\rightsquigarrow$
      EX(G-ONLY(BE(LIFT($\iota y . \text{THOUGHT-OF}(y, z)$)))))
      $\equiv \lambda P . \exists x [\text{ONLY}(x = \iota y . \text{THOUGHT-OF}(y, z)) \wedge P(x)]$

When this combines with *sends shivers down my spine*, we get:

(70) *Just the thought of him sends shivers down my spine* $\rightsquigarrow$
      $\exists x [\text{ONLY}(x = \iota y . \text{THOUGHT-OF}(y, z)) \wedge \text{SENDS-SHIVERS}(x)]$

---

[6]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 (60), a and b are p, and c is e, and f is ONLY.

So the sentence means 'There is an x that is [presupposed: at least the thought of him and] at most the thought of him which sends shivers down my spine. Higher-ranked alternatives in the QUD could be: 'x is his presence', 'x is his touch', etc. The sentence does not mean that such things do not send shivers down the spine; only that there is something which is not higher on the scale which does.

References

Beaver, David & Emiel Krahmer. 2001. A partial account of presupposition projection. *Journal of Logic, Language and Information* 10. 147–182.

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

Condoravdi, Cleo & Sven Lauer. 2014. Anankastic conditionals are just conditionals. Ms., Stanford University.

Coppock, Elizabeth & David Beaver. 2014. Principles of the exclusive muddle. *Journal of Semantics* 31(3). 371–432.

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

Grosz, Patrick. 2012. *On the grammar of optative constructions*. Amsterdam/Philadelphia: John Benjamins.

Guerzoni, Elena. 2003. *Why even ask? on the pragmatics of questions and the semantics of answers*: MIT dissertation.

Horn, Laurence R. 2011. *Only* XL: The assertoric asymmetry of exponibles. In Ed Cormany, Satoshi Ito & David Lutz (eds.), *Proceedings of Semantics and Linguistic Theory (SALT) 19*, 198–222. eLanguage.

Kratzer, Angelika. 1983. The notional category of modality. In H.-J. Eikmeyer & H. Rieser (eds.), *Words, worlds and contexts: New approaches to word semantics*, 38–74. Walter de Gruyter.

Partee, Barbara H. 1986. Noun phrase interpretation and type-shifting principles. In Jeroen Groenendijk, Dick de Jongh & Martin Stokhof (eds.), *Studies in Discourse Representation Theory and the theory of generalized quantifiers*, 115–143. Dordrecht: Foris.

Rosenkvist, Henrik. 2014. *The emergence of conditional subordinators in Swedish: A study in grammaticalization*: Lund University dissertation.

Stalnaker, Robert. 1968. A theory of conditionals. In Nicholas Rescher (ed.), *Studies in logical theory*, 98–112. Oxford: Oxford University Press.

Wijk-Andersson, Elsie. 1991. Bara *i fokus: en semantisk-syntaktisk studie av* bara *och dess ekvivalenter i nyskvenskt skriftspråk*: Uppsala University dissertation.