Minimal sufficiency as projection reversal

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Exclusives

Exclusive modifiers (*just, only, merely...*) are focus-sensitive expressions that negate alternatives to sentences in which they appear.

Sentences of the form *just p* are supposed to presuppose *p* and assert that alternatives to *p* are false (Horn, 1969; Rooth, 1992; Coppock and Beaver, 2014).

(1) I have **just one** question.

a. presuppose: I have one question

b. assert: I don't have more than one question

Minimal sufficiency

That's not what's happening in (2). These sentences instead display a minimal sufficiency reading.

(2) a. **Just looking at Jim Carrey** makes me laugh.
b. **Just three seconds** are sufficient to make a conclusion about fresh acquaintances.

How can the contribution of *just* in (2) be related to its contribution in (1)?

Minimal sufficiency

Evidence for a unified analysis: other English exclusives do this too.

(3) a. **Only a small percentage** would be enough for a big-scale scam to take off.

b. Researchers have found that **merely the status of being a mother** can lead to perceptions of lowered competence and commitment and lower salary offers.

c. Neutrogena Norwegian Formula Hand Cream delivers effective relief for dry, chapped hands. It is so concentrated that **only a small amount** instantly leaves even dry, cracked hands noticeably softer and smoother after **just one application**.

Minimal sufficiency

Evidence for a unified analysis: other languages do this too.

(4) Spanish

a. Responden a más de 5000 llamadas **en sólo dos meses**.
'They respond to over 5000 calls in just two months.'

b. Con **sólo un poco más de esfuerzo**, hubiéramos triunfado.
'We would have succeeded with just a little more effort.'

(5) German

a. **Allein der Gedanke daran** war überaus schmerzlich.
'Just the thought was painful.'

b. **Allein die Tatsache**, dass sich der Software Lifecycle Manager durchgängig als äußerst robustes System erwies, macht ihn zur ersten Wahl.
'Just the fact that the Software Lifecycle Manager has consistently proven to be a robust system makes it the first choice.'

Roadmap

The plan:

- I'll review the inferences associated with minimal sufficiency readings and their distribution.
- I'll discuss previous accounts of this phenomenon and why they don't work.
- I'll propose an analysis in terms of "projection reversal": basically, sentences with minimal sufficiency readings presuppose the exclusive content and assert the prejacent instead of the reverse.

Inferences

In sentences with exclusive readings, the exclusive content is at issue.

(6) I don't have **just one** question.
→ I have more than one question

In sentences with sufficiency readings, the prejacent is at issue.

(7) It's not true that **just looking at Jim Carrey** makes me laugh.
→ Looking at Carrey doesn't make me laugh

(8) It's not true that **just three seconds** are sufficient to make a conclusion about fresh acquaintances.
→ Three seconds aren't sufficient

Inferences

There is also a scalar presupposition: the focus associate is the lowest-ranked element to satisfy the scope predicate.

(9) a. Does **just looking at Jim Carrey** make you laugh?

b. It's possible that **just looking at Jim Carrey** makes you laugh.

c. If **just looking at Jim Carrey** makes you laugh, he must be really funny.
→ looking at Carrey is the minimally sufficient cause of your laughter (i.e., thinking about Carrey doesn't make you laugh)

Inferences

Some sentences with sufficiency readings also display an additive inference: the predicate also applies to higher scalar values.

(10) **Just looking at Jim Carrey** makes me laugh.
→Watching Carrey perform makes me laugh

(11) **Just three seconds** are sufficient to make a conclusion about fresh acquaintances.
→Four seconds are sufficient

Although:

(12) **Just five kicks** broke down the door.
↛Six kicks broke down the door

Distribution

Minimal sufficiency readings are not always available.

↑ = sufficiency reading; ↓ = exclusive reading

(13) Distributive predicates

a. **Just my sister** smiled. ↓

b. **Just five eggs** are in the fridge. ↓

c. I read **just three papers**. ↓

Distribution

Minimal sufficiency readings are not always available.

↑ = sufficiency reading; ↓ = exclusive reading

(14) Collective predicates, pt. 1... (Winter's (2002) "set predicates")

a. **Just the graduate students** gathered in my office. ↓
b. **Just the faculty** had a meeting. ↓
c. **Just two paintings** were identical. ↓

Distribution

Minimal sufficiency readings are not always available.

↑ = sufficiency reading; ↓ = exclusive reading

(15) ...collective predicates, pt. 2

("cumulative" predicates? "threshold" predicates?)

a. **Just 100 fossil fuel companies** are responsible for 71 percent of the world's carbon emissions. ↑

b. **Just thinking about lice** is enough to make your skin crawl. ↑

c. For the intellectual in this way of thinking, **just being what we are** counts as a political act. ↑

d. **Just a little** goes a long way. ↑

Distribution

When both distributive and collective readings are available, the interpretation of *just* covaries with the predicate.

(16) **Just five martinis** cost $100.

a. Five martinis each cost $100, and it's not the case that a sixth martini also cost $100. ↓

b. The cost of five martinis together added up to $100. ↑

Distribution

The distribution of minimal sufficiency readings appears to correlate with the acceptability of *together* as an NP modifier. (why??)

(17) a. #Five eggs **together** are in the fridge.
b. #The students **together** gathered in my office.
c. Five martinis **together** cost $100.

Distribution

Proposal: interpretation of *just* depends on the scalarity of the environment.

Downward scalar contexts = ordering relations over alternatives are **preserved** (not necessarily entailment).

(18) Just five students smiled.
→ 4, 3, etc students smiled.

5 > 4 > 3 > 2 > 1
5 students smiled → 4 students smiled → 3 students smiled

Distribution

Proposal: interpretation of *just* depends on the scalarity of the environment.

Upward scalar contexts = ordering relations over alternatives are **reversed** (not necessarily entailment).

(19) Just three seconds are sufficient.
→ 4, 5, etc seconds are sufficient.

5 > 4 > 3 > 2 > 1

3 seconds are sufficient → 4 seconds are sufficient → 5 seconds are sufficient

Previous literature

Grosz (2012) proposes lexical ambiguity: *just* is ambiguous between a normal exclusive entry and an entry like (20).

(20) $[\![\text{just}_2]\!] = \lambda p \lambda w. \frac{p(w)}{\text{LOW}(p)}$

Just$_2$ sentences assert the prejacent while presupposing that it's low on a scale.

✓ inferences
✗ distribution

Previous literature

Coppock and Beaver (2014) propose existential type-shifting: *just* takes local scope, while the exclusive content is obviated by an existential quantifier.

(21) ⟦Just the thought of food makes me hungry⟧
$= \exists x[\texttt{JUST}(x \text{ is the thought of food}) \wedge \texttt{makes-me-hungry}(x)]$
"something that is just the thought of food makes me hungry"

✗ inferences ...doesn't predict the scalar presupposition

✗ distribution

Previous literature

Panizza and Sudo (2020) propose existential type-shifting + covert *even*: similar to Coppock and Beaver's proposal, but an operator with the same semantics as *even* enforces the scalar presupposition and the additive inference.

(22) ⟦Just the thought of food makes me hungry⟧
$= \texttt{EVEN}(\exists x[\texttt{JUST}(x \text{ is the thought of food}) \wedge \texttt{makes-me-hungry}(x)])$
"something that is just the thought of food makes me hungry, and this is unlikely, and at least one likelier alternative is also true"

✗ inferences ...overgenerates additive inferences

Previous literature

The existential type-shift **Panizza and Sudo (2020)** propose to use is Winter's (2001) *C*, which is triggered by collective predication.

(23) $C := \lambda Q_{\langle et \rangle t} \lambda T_{\langle et \rangle t}. \exists P[P \in min(Q) \wedge T(P)]$

Successfully blocks sufficiency readings with distributive predicates, but not *met*, *gathered*, etc.

✗ inferences
✗ distribution

Projection reversal

Ok, so what's going on then?

Proposal: "projection reversal"

- Exclusive readings = presuppose the prejacent, assert the exclusive content.
- Sufficiency readings = presuppose the exclusive content, assert the prejacent.
- Scalarity of the environment determines which one we get: *just* sentences have to make an assertion about higher scalar values.

Projection reversal

What would happen if we applied a normal exclusive entry in an upward scalar environment?

(24) a. Just **three seconds** are sufficient.

b. Alternatives ordered by logical strength: {1 second is sufficient → 2 seconds are sufficient → 3 seconds are sufficient → 4 seconds are sufficient → 5 seconds are sufficient...}

- presuppose: 3 seconds are sufficient
- assert: fewer than 3 seconds aren't sufficient

Apparently we can't understand (24) that way.

Projection reversal

Proposal: the scalar presupposition exhibited by minimal sufficiency readings IS the exclusive content.

- If 3 seconds are necessary, then fewer than 3 seconds aren't sufficient.
- The prejacent is at issue because of projection reversal.
- The additive inference is either a logical or a contextual entailment.

Projection reversal

More formally:

(25) **Coppock and Beaver (2014)**

a. $\texttt{MIN} = \lambda p \lambda w . \exists q_{\in alt} : q(w) \wedge q \geq p$

b. $\texttt{MAX} = \lambda p \lambda w . \forall q_{\in alt} : q(w) \rightarrow p \geq q$

(26) Exclusive *just* $= \lambda p \lambda w . \frac{\texttt{MAX}(p)(w)}{\texttt{MIN}(p)(w)}$

(27) Sufficiency *just* $= \lambda p \lambda w . \frac{\texttt{MIN}(p)(w)}{\texttt{MAX}(p)(w)}$

Projection reversal

(27) Sufficiency *just* = $\lambda p \lambda w. \frac{\texttt{MIN}(p)(w)}{\texttt{MAX}(p)(w)}$

(28) $[\![\text{Just three seconds are sufficient.}]\!] = \lambda w. \frac{\texttt{MIN}([\![\text{3 seconds are sufficient}]\!])(w)}{\texttt{MAX}([\![\text{3 seconds are sufficient}]\!])(w)}$

(29) Alternatives ordered by logical strength: {1 second is sufficient → 2 seconds are sufficient → 3 seconds are sufficient → 4 seconds are sufficient → 5 seconds are sufficient...}

- assert: 3 seconds are sufficient ✓ prejacent is at-issue
- presuppose: 1-2 seconds aren't sufficient ✓ scalar presupposition
- entails: >3 seconds are sufficient ✓ additive inference

Projection reversal

(27) Sufficiency *just* = $\lambda p \lambda w. \frac{\texttt{MIN}(p)(w)}{\texttt{MAX}(p)(w)}$

(30) $[\![$Just looking at Jim Carrey makes me laugh.$]\!] = \lambda w. \frac{\texttt{MIN}([\![\text{looking at JC makes me laugh}]\!])(w)}{\texttt{MAX}([\![\text{looking at JC makes me laugh}]\!])(w)}$

(31) Alternatives ordered by pragmatic strength: {thinking about JC makes me laugh $\geq$ looking at JC makes me laugh $\geq$ watching JC perform makes me laugh...}

- assert: looking at JC makes me laugh ✓ prejacent is at-issue
- presuppose: thinking about JC doesn't make me laugh ✓ scalar presupposition
- does **not** entail: watching JC perform makes me laugh *unless additional contextual assumptions are made.* ✓ additive inference

Projection reversal

Ok, but why does projection reversal happen?

- **Option 1**: develop an enriched entry for *just* that reduces either to $\frac{\texttt{MIN}}{\texttt{MAX}}$ or $\frac{\texttt{MAX}}{\texttt{MIN}}$ in different linguistic environments.
- **Option 2**: develop a theory of presupposition in which lexical entries can underspecify the at-issue status of their semantic contributions, and derive projection reversal from a triggering algorithm.

Projection reversal

Coppock and Beaver (2014): exclusives have formal access to a contextually given ordering relation over propositional alternatives.

- **Projection reversal** suggests that they also have access to orderings over local alternatives to the focused expression.
- We either get $\frac{\texttt{MIN}}{\texttt{MAX}}$ or $\frac{\texttt{MAX}}{\texttt{MIN}}$ depending on whether the local ordering is isomorphic to the global ordering or the dual of the global ordering.

Projection reversal

Option 1: one entry for *just*.

Depends on the resolution of two free variables: R, an ordering over objects of the same type as the focused expression, and S, an ordering over alternative propositions.

(32) $[\![\text{just+}]\!] =$
$\lambda P \lambda x \lambda w. \frac{\forall q_{\in \texttt{above}}[q(w) \rightarrow P(x) \geq_S q] \wedge \neg \exists q_{\in \texttt{above}}[q \geq_S P(x)] \rightarrow \exists q[q(w) \wedge q \geq_S P(x)]}{\forall q_{\in \texttt{below}}[q(w) \rightarrow P(x) \geq_S q] \wedge \neg \exists q_{\in \texttt{below}}[q \geq_S P(x)] \rightarrow \exists q[q(w) \wedge q \geq_S P(x)]}$

(33) Auxiliary definitions

a. $\texttt{above} := \{q \in \texttt{FIELD}(S) | \exists Q[Q \in \texttt{FIELD}(R) \wedge Q \geq_R P \wedge Q(x) = q\}$

b. $\texttt{below} := \{q \in \texttt{FIELD}(S) | \exists Q[Q \in \texttt{FIELD}(R) \wedge P \geq_R Q \wedge Q(x) = q\}$

c. $\texttt{FIELD}(\geq) := \{x | \exists y[x \geq y \vee y \geq x]\}$

Projection reversal

(34) Just three eggs are in the fridge.

a. `above` = {3 eggs are in the fridge, 4 eggs are in the fridge, 5 eggs are in the fridge...}

b. `below` = {1 egg is in the fridge, 2 eggs are in the fridge, 3 eggs are in the fridge}

(35) Just three seconds are sufficient.

a. `above` = {3 seconds are sufficient, 4 seconds are sufficient, 5 seconds are sufficient...}

b. `below` = {1 second is sufficient, 2 seconds are sufficient, 3 seconds are sufficient}

Projection reversal

(32) $[\![\text{just+}]\!] =$
$\lambda P \lambda x \lambda w. \frac{\forall q_{\in \texttt{above}}[q(w) \rightarrow P(x) \geq_S q] \wedge \neg \exists q_{\in \texttt{above}}[q \geq_S P(x)] \rightarrow \exists q[q(w) \wedge q \geq_S P(x)]}{\forall q_{\in \texttt{below}}[q(w) \rightarrow P(x) \geq_S q] \wedge \neg \exists q_{\in \texttt{below}}[q \geq_S P(x)] \rightarrow \exists q[q(w) \wedge q \geq_S P(x)]}$

In downward scalar contexts, the boxed content is contingent and the dimmed content is trivial:

(36) $\dfrac{\boxed{\forall q \in \texttt{above}[q(w) \rightarrow P(x) \geq_S q]} \wedge \neg \exists q_{\in \texttt{above}}[q >_S P(x)] \rightarrow \exists q[q(w) \wedge q \geq_S P(x)]}{\forall q_{\in \texttt{below}}[q(w) \rightarrow P(x) \geq_S q] \wedge \boxed{\neg \exists q \in \texttt{below}[q >_S P(x)] \rightarrow \exists q[q(w) \wedge q \geq_S P(x)]}}$

$\approx \frac{\texttt{MAX}}{\texttt{MIN}}$

Projection reversal

(32) $[\![\text{just+}]\!] =$
$\lambda P \lambda x \lambda w. \frac{\forall q_{\in \texttt{above}}[q(w) \rightarrow P(x) \geq_S q] \wedge \neg \exists q_{\in \texttt{above}}[q \geq_S P(x)] \rightarrow \exists q[q(w) \wedge q \geq_S P(x)]}{\forall q_{\in \texttt{below}}[q(w) \rightarrow P(x) \geq_S q] \wedge \neg \exists q_{\in \texttt{below}}[q \geq_S P(x)] \rightarrow \exists q[q(w) \wedge q \geq_S P(x)]}$

In upward scalar contexts we find the reverse situation:

(37) $\dfrac{\forall q \in \texttt{above}[q(w) \rightarrow P(x) \geq_S q] \wedge \boxed{\neg \exists q \in \texttt{above}[q >_S P(x)] \rightarrow \exists q[q(w) \wedge q \geq_S P(x)]}}{\boxed{\forall q \in \texttt{below}[q(w) \rightarrow P(x) \geq_S q]} \wedge \neg \exists q \in \texttt{below}[q >_S P(x)] \rightarrow \exists q[q(w) \wedge q \geq_S P(x)]}$

$\approx \frac{\texttt{MIN}}{\texttt{MAX}}$

Projection reversal

Option 2: underspecification.

- **Option 1** is not very enlightening.
- Ideally we'd have a theory of presupposition in which *just* can contribute `MIN` and `MAX` without specifying them for at-issue status, and projection reversal just falls out from how *just* composes in its environment.
- What would this look like?

Projection reversal

Presupposition triggering: "given some information that a linguistic expression conveys about the world, can we predict which part is at-issue and which part is presupposed?" (Schlenker, 2021, pg. 2)

(38) Gladys stopped smoking.
Gladys smoked and Gladys doesn't smoke $\rightsquigarrow$ $\frac{\text{Gladys doesn't smoke}}{\text{Gladys smoked}}$

Projection reversal

If our only goal were to predict the behavior of *just*, this would be easy:

(39) Trigger a **presupposition** p iff
$\forall q_{\in \texttt{FIELD}(S)}[p \subseteq \neg q \rightarrow q \in \texttt{below} \vee q \subseteq p \rightarrow q \in \texttt{above}]$

This will target MIN in downward scalar contexts and MAX in upward scalar contexts.

Projection reversal

Ideally though the behavior of *just* would fall out from a more general theory.

- Simons et al. (2010): project anything that doesn't address the current QUD.
- Schlenker (2021): project content that must be antecedently believed in order to learn the at-issue content.

These don't obviously predict that *just* should have to make an assertion about higher scalar values.

Open questions

There are lots of questions here.

- What sort of triggering algorithm do we need?
- Why is projection tied to scalarity?
- What typology of predicates do we need?

Thanks!

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Bonus

Not all English exclusives allow minimal sufficiency readings.

(40) #{**Exclusively/solely**} **looking at Jim Carrey** makes me laugh.

Also some people find them marginal with *only*.

(41) %**Only a small percentage** would be enough for a big-scale scam to take off.

Bonus

Fagen (2022, 2024): exclusives select for alternative sets with different algebraic structures.

- *Just, merely*: require totally ordered alternatives.
- *Exclusively, solely*: require totally unordered alternatives.
- *Only* is ok with any partial ordering.

Bonus

Compatibility with minimal sufficiency readings

- *Exclusively, solely*: unordered alternatives → no possibility of scale reversal → no sufficiency readings.
- If it's easier to accommodate the reversal of a totally ordered scale than a partially ordered scale, this could support an account of why speakers have a pragmatic preference for *just* and *merely* over *only*.