Structural complexity in formal pragmatics

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Part 1: Introducing strengthening and the symmetry problem

Goal for the first two classes: crash course on scalar inferences and related strengthening phenomena, to lay groundwork for discussion of open problems/very recent literature

This mini-course is mostly based on ongoing joint work with Viola Schmitt (Haslinger & Schmitt (to appear) and later unpublished work), who I would like to thank for many useful discussions on the subject.

- introduce some linguistic phenomena that involve *strengthening based on the exclusion of alternatives*

(1) a. **some** ⇝ 'some but not all'
b. **warm** ⇝ 'warm but not hot'

- establish that this is pervasive in natural language
- introduce the core challenge for theories of strengthening: dealing with *symmetric* sets of alternatives—sets of potential alternatives that could each individually be excluded, but not all at the same time[1]
  - in some cases, one of the alternatives in a symmetric set can be excluded, the other one can't

    (2) a. ✓ **some** ⇝ 'some but not all' via exclusion of **all**
    b. ✗ **some** ⇝ 'all' via exclusion of **some but not all**

  - in other cases, the alternatives in the symmetric set seem to block each other from being excluded (Fox 2007), resulting in no strengthening at all or only ignorance inference

    (3) a. ✗ **raining or snowing** ⇝ 'raining but not snowing' via exclusion of **snowing**
    b. ✓ **raining or snowing** ⇝ 'possibly raining, and possibly snowing'[2]

  ⇒ When do we find one of these two phenomena and when do we find the other?

- informally introduce a characterization of this puzzle that is common in the literature
  - requirement for alternatives to be relevant never resolves symmetry
  - in cases like (2) one of the alternatives is kicked out because it is *structurally too complex*
  - in cases like (3) neither alternative is too complex, so both must be retained

[1] See Katzir (2007), Fox & Katzir (2011) for this characterization of the puzzle, which they attribute to Kroch (1972).

[2] For discussion of such inferences, see e.g. Gazdar 1979, Sauerland 2004.

1 Scalar inferences

- The paradigmatic examples of strengthened meanings involve 'weak' logical operators (**may**, **possible**, **some**, **or**, ...) or 'weak' predicates (e.g. **warm** vs. **hot**).
- Sentences containing such expressions systematically trigger the inference that ALTERNATIVES containing stronger expressions of the same category are false.

I use **boldface** for object-language expressions throughout this class. In examples involving complex discourses, I underline the subexpressions whose alternatives or strengthened meanings I am discussing.

(4) Jane: **What is the final project for this class?**
Mary: **You won't have to write a paper.**
You are allowed to present a poster.
⇝ Jane is not required to present a poster

(5) CONTEXT: The syllabus says that students who pass the exam get an A if they also did all of the problem sets, and a B if they did some, but not all of the problem sets.
Jane: **So what about Paul? What grade will he get?**
Mary: **Paul did some of the problem sets and he passed the exam. (So he's going to get a B.)**
⇝ Paul didn't do all of the problem sets

(6) Jane: **What's the temperature of the water?**
Mary: **It's warm.**
⇝ the water is not hot

- To substantiate the point that these are actually inferences drawn from the utterance (rather than just properties of some of the situations in which the utterance is true) note that they can be brought out by **Are you saying ...** responses (Meyer 2013).[3]

(7) a. [discourse as in (4)]
Jane: **Are you saying I'm not required to present a poster?**
b. [discourse as in (5)]
Jane: **Are you saying he did not do all the problem sets and will get a B?**
c. [discourse as in (6)]
Jane: **Are you saying it's not hot?**

- In the **allowed** and **some** cases, this behavior does not follow from the standard lexical semantics
  - Classical existential quantifier satisfied even if the nuclear-scope predicate holds of *all* individuals in the restrictor set[4]

(8) $[\![$**Paul did some of the problem sets**$]\!]^{c,w}$
$= 1$ iff $\exists x[x$ is a problem set in $w \wedge$ Paul did x in $w]$

  - Existential modal sentences predicted to be true even if the prejacent[5] of the modal is true in *all* accessible worlds

[3] The **Are you saying ...** diagnostic can target all kinds of inferences, including those drawn in a probabilistic manner based on the knowledge that a sentence is likely to be uttered in a certain kind of situation. So unlike Meyer, I take it to be a diagnostic for *inferences*, but not a valid diagnostic for *strengthening*.

[4] I will assume that expressions are assigned extensions relative to a world and a context, writing $[\![\phi]\!]^{c,w}$ for the extension of ϕ relative to a world w and a context c, and omitting c when it is irrelevant.
I further write $[\![\phi]\!]^{c}$ for the intension of ϕ relative to context c, i.e. the function $[\lambda w.[\![\phi]\!]^{c,w}]$ that maps worlds to extensions of c in these worlds.

[5] The PREJACENT of a unary proposition-embedding operator is its propositional argument.

(9) $[\![$**[allowed** $f_{\langle 1,\langle s,\langle s,t\rangle\rangle\rangle}$**] [you present a poster]**$]\!]^{c,w}$
= 1 iff $\exists w'[g_c(\langle 1, \langle s, \langle s,t\rangle\rangle\rangle)(w)(w') \wedge$ Jane presents a poster in $w']$

In interpreting variables such as pronouns, I take the assignment function to be a component g_c of the context rather than a separate parameter of the semantic evaluation function. Here the variable $f_{\langle 1,\langle s,\langle s,t\rangle\rangle\rangle}$ stands for a contextually provided relation between possible worlds—in the present example, roughly those possible worlds that conform completely to the course regulations. The semantic effect of the modal is to quantify over the possible worlds related to the 'actual' world w by this relation. For more background on modals, see e.g. von Fintel & Heim (2021).

- In principle we could modify the lexical entries to lexically encode 'some but not all' for **some**, 'allowed but not required' for **allowed**, etc.

(10) standard 'weak' lexical entries

a. $[\![\textbf{allowed}]\!]^w = \lambda p_{\langle s,t\rangle}.\lambda f_{\langle s,\langle s,t\rangle\rangle}.\exists w'[f(w)(w') = 1 \wedge p(w') = 1]$

b. $[\![\textbf{some}]\!]^w = \lambda P_{\langle e,t\rangle}.\lambda Q_{\langle e,t\rangle}.\exists x[P(x) = 1 \wedge Q(x) = 1]$

(11) 'strong' lexical entries

a. $[\![\textbf{allowed}]\!]^w = \lambda p_{\langle s,t\rangle}.\lambda f_{\langle s,\langle s,t\rangle\rangle}.\exists w'[f(w)(w') = 1 \wedge p(w') = 1] \wedge \neg\forall w'[f(w)(w') = 1 \rightarrow p(w') = 1]$

b. $[\![\textbf{some}]\!]^w = \lambda P_{\langle e,t\rangle}.\lambda Q_{\langle e,t\rangle}.\exists x[P(x) = 1 \wedge Q(x) = 1] \wedge \neg\forall x[P(x) = 1 \rightarrow Q(x) = 1]$

(12) Using the 'strong' lexical entry:
$[\![$**[allowed** $f_{\langle 1,\langle s,\langle s,t\rangle\rangle\rangle}$**] [you present a poster]**$]\!]^{c,w}$
= 1 iff $\exists w'[g_c(\langle 1, \langle s, \langle s,t\rangle\rangle\rangle)(w)(w') \wedge$ Jane presents a poster in $w']$
$\wedge\neg\forall w'[g_c(\langle 1, \langle s, \langle s,t\rangle\rangle\rangle)(w)(w') \rightarrow$ Jane presents a poster in $w']$

- In the case of predicates like **warm**, where we are not biased by classical logic, one would probably intuitively posit the strong lexical meaning in (13-b) and not the weak one in (13-a).

(13) Assume a temperature scale with contextually given thresholds $d^c_{\textbf{warm}}$ and $d^c_{\textbf{hot}}$, where $d^c_{\textbf{hot}} > d^c_{\textbf{warm}}$

a. $[\![\textbf{warm}]\!]^{c,w} = \lambda x.x$'s temperature in $w > d^c_{\textbf{warm}}$

b. $[\![\textbf{warm}]\!]^{c,w} = \lambda x.x$'s temperature in $w > d^c_{\textbf{warm}}$
$\wedge x$'s temperature in $w \leq d^c_{\textbf{hot}}$

- But on closer inspection these strong lexical entries are a bad idea, because these inferences do not 'behave' like lexically triggered entailments.[6]

[6] See e.g. Grice (1975), Horn (1972), Gazdar (1979) a.m.o.

Q *What makes these inferences unlike typical entailments?*

- They can be cancelled as in (14), or 'suspended' (Horn 1972) as in (15), without any feeling of contradiction. Many (although not all) scalar inferences can also be blocked by **at least** (102).

(14) a. **You are allowed to present a poster. In fact, you are required to present a poster.**

b. **Paul did some of the problem sets. In fact, he did all of them, so he will get an A.**

c. **The water is warm. In fact, it's hot.**

(15) a. **You are allowed, and possibly even required, to present a poster.**

b. **Paul did some, if not all, of the problem sets.**
c. **The water is warm, and possibly hot.**

(16) a. **Paul did at least some of the problem sets.**
b. **The water is at least warm.**

– You can explicitly reinforce them without triggering a feeling of redundancy.[7]

(18) a. **You are allowed to present a poster, but you are not required to present a poster.**
b. **The water is warm, but it's not hot.**

– If we embed **some, allowed**, etc. in a downward-entailing (DE) environment[8], the interpretation predicted by the 'weak' lexical entry is the salient one. An interpretation based on the 'strong' entry is available marginally, if at all.[9]

(19) **You are not allowed to present a poster.**
a. Correct truth conditions using the 'weak' entry:
$\neg\exists w'[g_c(\langle 1, \langle s, \langle s, t\rangle\rangle\rangle)(w)(w') \wedge$ Jane presents a poster in $w']$
b. Overly weak truth conditions using the 'strong' entry:
$\neg\exists w'[g_c(\langle 1, \langle s, \langle s, t\rangle\rangle\rangle)(w)(w') \wedge$ Jane presents a poster in $w']$
$\vee\forall w'[g_c(\langle 1, \langle s, \langle s, t\rangle\rangle\rangle)(w)(w') \rightarrow$ Jane presents a poster in $w']$

If Jane is required to present a poster (i.e. she presents one in every accessible world w') (19-a) is false, but (19-b) is true.

– It is possible to force the readings predicted by the 'strong' entries by putting the nuclear accent on the scalar element (e.g. **allowed**) and deaccenting everything afterwards:

(20) **You are not ALLOWED to present a poster. You are REQUIRED to present a poster.**

But crucially this doesn't seem like a lexical phenomenon, but rather like a very general strategy for turning usually non-asserted ('projective') content into regular entailments:[10]

(21) a. **Mary isn't late to the meeting AGAIN . . . she has never been late before.** (Horn 1989)
b. **John can't KNOW that the earth is flat, because that's not true.**

This suggests that by default, these inferences do not behave like regular entailments of an expression occurring in the scope of the DE operator.

- Another reason why capturing this pattern in terms of 'strong' lexical entries is a bad idea is that it is too general to reflect a lexical property that would have to be encoded (or acquired) item by item.

[7] For comparison, consider the behavior of **optional**, which entails 'not required' and therefore fails these tests:

(17) a. #**Presenting a poster is optional. In fact, it's required.**
b. ??**Presenting a poster is optional, and possibly even required.**
c. ??**Presenting a poster is optional, but not required.**

Similarly, **lukewarm** is unlike **warm** in that it entails 'not hot' and therefore fails the tests as well.

[8] Consider a sentence ϕ with an occurrence ψ of a type t constituent. We write $\phi[\psi/\alpha]$ for the result of replacing ψ with some other type t expression α. Then ψ is in a **downward-entailing environment** in ϕ iff for all type t constituents α and β, if α entails β, then $\phi[\psi/\beta]$ entails $\phi[\psi/\alpha]$.

[9] See e.g. Chemla & Spector (2011) for relevant experimental work (on French).

[10] See e.g. Horn 1972, 1989 for descriptions of this pattern, and Bassi et al. 2021 for an interesting recent attempt to integrate the phenomenon into newer theories of strengthening.

- The optional 'not required' inference of **allowed** and the exact way in which it is optional (cancellability, reinforcability, embedding pattern, ...) carries over to **may, can, possible**, etc.
- The pattern found e.g. in the modal domain carries over to 'weak' operators in other semantic domains (**some, or, partly, approximately**, ...)
- This suggests that these inferences are the result of a general mechanism of STRENGTHENING that can't be turned on or off on a lexical basis.
  - The BASIC MEANINGS of weak scalar items lack the inferences in question, as exemplified in (10).
  - But it is possible to derive a STRENGTHENED MEANING for sentences containing such items by enriching the basic truth conditions of the sentence with the negations of certain ALTERNATIVES.
  - Following most of the literature, we will take these alternatives to be *other linguistic expressions* generated by the syntax.[11]
  - In many cases, they are derivable by replacing a lexical item, a so-called SCALAR ITEM, with a scalar item of the same syntactic category (Horn 1972).

(22) a. **you are allowed to present a poster**
b. alternative: **you are required to present a poster**

(23) a. **Paul did some of the problem sets**
b. alternative: **Paul did all of the problem sets**

(24) a. **The water is warm.**
b. alternative: **The water is hot**

  - We will later consider a more permissive theory of how alternatives are generated which, however, still involves constraints on their syntactic form.
- *Next step*: Look a bit more precisely at some possible mechanisms that produce strengthened meanings, and other linguistic phenomena that appear to involve alternatives in a similar way.

[11] However, for work on strengthening that does not (always) take the alternatives to be based on linguistic expressions, see e.g. Buccola et al. 2022 as well as the literature on strengthening of (in)definites wrt. so-called SUBDOMAIN ALTERNATIVES (e.g. Chierchia 2013, Bar-Lev 2021, Guerrini & Wehbe 2024, Crnič 2025 a.o.).

2 *Strengthening mechanisms and strengthening phenomena*

- *Goals of this section*:
  - introduce two core approaches to scalar inferences: neo-Gricean and grammatical theories
  - introduce some instances of strengthening phenomena beyond scalar inferences: exhaustive particles (*only*), presupposition strengthening
- We assume that strengthening applies to a syntactic expression ϕ of type t[12] uttered in a context c.

[12] The grammatical approach discussed in Section 2.2 below can be extended to other types that end in t.

- The prerequisite for strengthening is an ALTERNATIVE SET $ALT_c(\phi)$—a set of expressions of type t (not denotations!) that contains ϕ and depends on
  - the full syntactic structure of ϕ[13]
  - and the utterance context c, particularly the QUESTION UNDER DISCUSSION Q_c that is salient in c.

(25) ALT_c(**Paul did some of the p-sets**)
$= \{$**Paul did some of the p-sets**, **Paul did all of the p-sets**$\}$

- One effect of context (there might be others) is that $ALT_c(\phi)$ contains only sentences that express a proposition that is in some sense RELEVANT to Q_c. We'll expand on this point later.
- A relevant alternative $\psi \in ALT_c(\phi)$ can give rise to two kinds of inferences:
  - SCALAR INFERENCE: ψ is *false* (or at least *believed to be false* by the speaker in c)
  - UNCERTAINTY INFERENCE: the speaker in c is *not certain* that ψ is true [14]

(26) Mary: **Paul did some of the problem sets**.
a. UNCERTAINTY: Mary is not certain that **Paul did all of the problem sets** is true
$\approx$ There is at least one world w compatible with Mary's belief state such that Paul did not do all of the problem sets in w
b. SCALAR: (Mary is certain that) **Paul did all of the problem sets** is false
$\approx$ (Every world w compatible with Mary's belief state is such that) Paul did not do all of the problem sets (in w).

- In the SCALAR paraphrase, I bracketed the part about speaker belief for the following reason:
  - On the traditional (NEO)-GRICEAN APPROACH, reasoning about the speaker's belief state is crucial to the derivation of scalar inferences[15]
  - But today, much of the literature has moved away from this assumption and attributes scalar inferences to an operator that applies during semantic composition—roughly a silent variant of **only**. This is known as a GRAMMATICAL APPROACH[16]
- Here I will briefly introduce both perspectives using the example of (27-a); I stipulate that the relevant alternative set is (27-b).

(27) a. ϕ = **Paul did some of the problem sets**
b. $ALT_c(\phi) = \{$**Paul did some of the problem sets**, **Paul did all of the problem sets**$\}$

[13] This means that strengthened meanings are not compositional in the strict sense that requires the meaning of a complex expression to be a function of the meanings of its immediate constituents and the way they are combined. This is not inherently problematic as long as we have a theory that derives the correct range of strengthened meanings for expressions of arbitrary complexity.

[14] In a possible-worlds model of belief states (Hintikka 1969), *not certain* means that the speaker's belief state is compatible with at least one possible world in which ψ isn't true. This is met both if the speaker believes ψ to be false (i.e. if ψ is false in all the worlds compatible with their belief state) and if they are IGNORANT about ψ (i.e. if ψ is true in some worlds compatible with their belief state and false in others).
Much of the recent literature distinguishes between uncertainty inferences and IGNORANCE INFERENCES, which require the speaker to be ignorant about an alternative ψ and are incompatible with the speaker believing ψ to be false. It is commonly claimed (e.g. Meyer 2013, 2014) that items like **some** or **allowed** do not trigger ignorance inferences (unlike e.g. disjunctions).

[15] See e.g. Grice 1975, Horn 1972, Gazdar 1979 for classic work in this vein and Sauerland 2004 for a more recent, very explicit discussion.

[16] See e.g. Chierchia et al. 2012 for an introduction to this view. Meyer (2013, 2014) extends the grammatical perspective to uncertainty and ignorance inferences; Fox (2014) argues that we want a grammatical mechanism for scalar inferences, but a (neo-)Gricean one for ignorance.

2.1 *The neo-Gricean perspective*

- Strengthening inferences involve reasoning about what the speaker *should have said if they had a certain belief state*, but didn't.
- Grice (1975) formulates a collection of CONVERSATIONAL MAXIMS that we expect a cooperative speaker to follow.
- Later work (Gazdar 1979) formalizes these maxims in terms of a possible-worlds model of epistemic states (Hintikka 1969).
- Let's write $B_w(s)$ for the set of worlds that are *fully compatible with the beliefs of speaker s in world w*.
- Then Grice's Maxim of Quality[17] can be formalized by saying that a cooperative speaker will only assert a sentence ϕ if it is true in all these worlds:

(28) NEO-GRICEAN MAXIM OF QUALITY
Given an utterance context c with a cooperative speaker s_c and an LF ϕ:
s_c will utter ϕ in c only if $B_{w_c}(s_c) \subseteq \{w : [\![\phi]\!]^{c,w} = 1\}$, where w_c is the utterance world of c.

- A cooperative speaker additionally has to make their utterance relevant (more on this later)

(29) NEO-GRICEAN MAXIM OF RELEVANCE
Given an utterance context c with a cooperative speaker s_c and an LF ϕ:
s_c will utter ϕ in c only if $[\![\phi]\!]^c$ is relevant to Q_c.

- Finally, given multiple potential utterances that satisfy Quality and Relevance, a cooperative speaker will prefer a stronger alternative over a weaker one:

(30) NEO-GRICEAN MAXIM OF QUANTITY
Given an utterance context c with a cooperative speaker s_c and two LFs ϕ and ψ such that
a. $B_{w_c}(s_c) \subseteq \{w : [\![\phi]\!]^{c,w} = 1\}$ and $B_{w_c}(s_c) \subseteq \{w : [\![\psi]\!]^{c,w} = 1\}$ (i.e. s_c believes both $[\![\phi]\!]^c$ and $[\![\psi]\!]^c$ to be true)
b. and both $[\![\phi]\!]^c$ and $[\![\psi]\!]^c$ are relevant to the question Q_c
c. and ψ is logically stronger than ϕ, i.e. $\{w : [\![\phi]\!]^{c,w} = 1\} \supset \{w : [\![\psi]\!]^{c,w} = 1\}$
d. and $\psi \in ALT_c(\phi)$

then s_c will prefer uttering ψ over uttering ϕ.

- The assumption that the speaker is obeying these three maxims will allow us to derive uncertainty inferences (cf. Gazdar 1979, Sauerland 2004)

[17] Grice (1975) gives a different formulation involving two submaxims:

1. Do not say what you believe to be false.
2. Do not say that for which you lack adequate evidence.

Submaxim 2 is arguably stronger than the formalization in terms of belief worlds might suggest: A speaker might in principle be completely certain that a given proposition is true, but not certain that they have adequate evidence for it.

(31) Jane: **What about Paul? What grade will he get?**
Mary: **Paul did some of the problem sets and he passed the exam.**
Jane: **Are you saying he did not do all the problem sets and will get a B?**

- Assume that the context c is such that **Paul did all of the problem sets** $\in ALT_c($**Paul did some of the problem sets**$)$.
- Then by Quality, $B_{w_c}(\text{Mary}) \subseteq \{w : [\![\textbf{Paul did some of the problem sets}]\!]^{c,w} = 1\}$
- Given Jane's question, $[\![\textbf{Paul did some of the problem sets}]\!]^c$ and $[\![\textbf{Paul did all of the problem sets}]\!]^c$ are both relevant.
- Further, **Paul did all of the problem sets** is logically stronger.
- So if $B_{w_c}(\text{Mary}) \subseteq \{w : [\![\textbf{Paul did all of the problem sets}]\!]^{c,w} = 1\}$ were true, Quantity would require Mary to utter the **all**-alternative.
- Since she didn't and is obeying Quantity, it must be the case that $B_{w_c}(\text{Mary}) \not\subseteq \{w : [\![\textbf{Paul did all of the problem sets}]\!]^{c,w} = 1\}$, i.e. Mary is not certain that **Paul did all the problem sets** is true.

- This reasoning by itself won't get us to scalar inferences, i.e. it won't get us from the conclusion that the speaker is not certain that a given alternative is true to the conclusion that they are certain it is false.

- In a neo-Gricean setting, scalar inferences are assumed to require a COMPETENCE or OPINIONATEDNESS ASSUMPTION—an assumption that the speaker is not ignorant about the alternative.

(32) A speaker s is IGNORANT about a proposition p in c iff $B_{w_c}(s)$ entails neither of p and $\neg p$.

- The assumption that Mary is not ignorant about $p = [\lambda w.\text{Paul did all the problem sets in } w]$ amounts to a disjunction:
  $B_{w_c}(\text{Mary}) \subseteq \{w : p(w) = 1\} \vee B_{w_c}(\text{Mary}) \subseteq \{w : p(w) = 0\}$.
- From the above reasoning based on Quantity, we know that $B_{w_c}(\text{Mary}) \not\subseteq \{w : p(w) = 1\}$
- So, we can infer $B_{w_c}(\text{Mary}) \subseteq \{w : p(w) = 0\}$, i.e. $B_{w_c}(\text{Mary}) \subseteq \{w : \text{Paul did not do all the problem sets in } w\}$.

- Strictly speaking, on this approach, we are not really strengthening the meaning of the sentence.

- We are strengthening the *inference about speaker belief* that we get from Quality with another inference about speaker belief that we get from Quantity.

- Note also that the reasoning underlying Quantity is contingent on the alternatives being *stronger* than the prejacent.

  But as already noted by Horn (1972), analogous inferences can be triggered by alternatives that do not stand in any logical relation to the prejacent.

(33) CONTEXT: At MIT it is possible to graduate with a PhD without getting an MA first, but it is also possible to get an MA and then a PhD.
Jane: **What kind of degree does Mary have from MIT?** Paul: **She has an MA.**
⇝ Mary doesn't have a PhD from MIT
(✓Jane: **Are you saying she doesn't have a PhD?**) [18]

– This inference can evidently be cancelled, suspended and reinforced in the same way as scalar inferences based on entailment:

(34) a. **Mary has an MA from MIT, if not a PhD / and possibly even a PhD.**
b. **Mary has an MA from MIT. In fact she also has a PhD.**[19]
c. **Mary has an MA from MIT, but not a PhD.**
d. **Mary has at least an MA from MIT.**

– *Obvious response*: try to generalize the Quantity maxim to apply not just to stronger alternatives, but also to logically independent alternatives if they are higher on some 'expectedness' scale (cf. Horn 1972).
– *Another response*: maybe this shows us that reasoning about what a cooperative speaker should have done is not sufficient to account for all scalar inferences
– We'll now look at an implementation of this latter approach, based on an analogy with another strengthening phenomenon that doesn't easily fit the neo-Gricean picture

[18] Note that there is an asymmetry here (albeit only a context-dependent one) that seems to be related to the social hierarchy and typical temporal ordering between **MA** and **PhD**: **She has a PhD** is less likely to trigger the inference that she doesn't have an MA, and e.g. **Mary has at least a PhD** is harder to accept with a 'MA or PhD' reading.

[19] On this use of **also** in the second conjunct, see Bade (2014) and Paillé (2022), who essentially analyze it as an 'anti-exhaustivity' strategy needed to avoid the strengthening of the first conjunct that would otherwise take place.

2.2 *Exhaustive particles*

• Far-reaching (although not perfect) parallelism between scalar inferences triggered without overt marking and inferences triggered by EXHAUSTIVE PARTICLES/EXHAUSTIFYING OPERATORS like **only** or **just**

• What happens when **only** or **just** modifies an expression containing a scalar item?[20]

– a scalar inference is *obligatorily* computed[21]

(35) a. **Paul did only some of the problem sets.** ⇝ Peter didn't do all
b. **The water is just warm.** ⇝ the water isn't hot
c. **Mary only has an MA from MIT.** ⇝ she doesn't have a PhD from MIT

(36) a. **Paul did only some of the problem sets (# and possibly all).**
b. **The water is just warm (# and possibly it is hot).**
c. **Mary only has an MA from MIT (# and possibly she has a PhD from MIT).**

[20] See e.g. Horn (1972) for this characterization of **only**. The distribution of **only** is a bit more restricted than the description below predicts (e.g. it is not great with some existential modals, a phenomenon that the standard approach doesn't really explain), and **only** and **just** target somewhat different types of alternatives. I will abstract away from this here.

[21] Note that (36) shows that **only** cannot trigger uncertainty inferences (unless it conspires with other operators, such as modals, in its scope to produce the effect of an uncertainty inference).

– this inference receives the status of asserted/at issue content[22]

– the prejacent itself receives the status of a presupposition

(37) Jane: **What about Paul? What grade will he get?**
Mary: **Paul did only some of the problem sets and he passed the exam.**
⇝ Paul did not do all of the problem sets

(38) A simple semantic rule for **only** [to be revised][23]
$[\![\textbf{only}\ \phi]\!]^{c,w}$

$$= \begin{cases} 1 & \text{iff } [\![\phi]\!]^{c,w} = 1 \wedge \forall \psi \in ALT_c(\phi)[[\![\phi]\!]^c \not\subseteq [\![\psi]\!]^c \rightarrow [\![\psi]\!]^{c,w} = 0] \\ 0 & \text{iff } [\![\phi]\!]^{c,w} = 1 \wedge \exists \psi \in ALT_c(\phi)[[\![\phi]\!]^c \not\subseteq [\![\psi]\!]^c \wedge [\![\psi]\!]^{c,w} = 1] \\ \# & \text{iff } [\![\phi]\!]^{c,w} \neq 1 \end{cases}$$

– Here # stands for a third truth value that models presupposition failure/perceived 'undefinedness'

– **only** ϕ is a presupposition failure if ϕ is not true[24]

– if ϕ is true, **only** ϕ asserts that all alternatives in $ALT_c(\phi)$ are false, except those entailed by ϕ[25]

(40) $[\![\textbf{only [Paul did some of the p-sets]}]\!]^{c,w}$

$$= \begin{cases} 1 & \text{iff Paul did some of the problem sets in } w \\ & \wedge\neg[\text{Paul did all of the problem sets in } w] \\ 0 & \text{iff Paul did all of the problem sets in } w \\ \# & \text{iff Paul did not do any of the problem sets in } w \end{cases}$$

- So the effect of **only** is basically a scalar inference—but without any reasoning about speaker belief; we are just strengthening the truth-conditional meaning of the sentence

- Why do we need to analyze **only** in terms of truth-conditional strengthening, i.e. why can't we treat **only** as a marker that 'forces' Gricean reasoning about speaker belief?

For one thing, the strengthening operation triggered by **only** can be computed in the scope of an embedding operator

(41) **Half of the students did all the problem sets, and half of them did only some of the problem sets**.

(42) Scenario: Half of the students did all the problem sets. The other half did some, but not all. (41) ✓

To obtain a reading of (41) that is true in scenario (42), strengthening has to apply in the scope of the quantifier **half of the students**:

(43) correct interpretation with narrow-scope **only**[26]

a. **[half of the students] [1 [only [t_1 did some of the p-sets]]]**

b. ALT_c($\mathbf{t_1}$ **did some of the problem sets**)
$= \{$$\mathbf{t_1}$ **did some of the p-sets**, $\mathbf{t_1}$ **did all of the p-sets**$\}$

[22] In the (neo-)Gricean tradition, it is often pointed out that scalar inferences do not behave like asserted content. For a long time, work in the grammatical tradition has disregarded this issue, simply conjoining the inferences with the truth conditional meaning. But recent work by Bassi et al. (2021), del Pinal et al. (2024) show that even within the grammatical tradition, there are advantages to treating scalar inferences as something like presuppositions.

[23] Note that this is a syncategorematic semantic rule, i.e. a rule that interprets complex expressions without assigning meanings to all their parts. This is unavoidable here because the set $ALT_c(\phi)$ is sensitive to the structure of ϕ, not just its denotation, so a semantic effect that depends on $ALT_c(\phi)$ cannot be obtained from the extension or intension of ϕ via regular composition rules.

[24] Why not simply make it false if ϕ is not true? Because the inference that the prejacent of **only** is true persists when the **only** structure is embedded in downward-entailing environments:

(39) a. **Paul didn't do only some of the problem sets.** ⇝ Paul did at least some of the problem sets
b. **The water isn't just warm.** ⇝ the water is at least warm

[25] Negating alternatives entailed by ϕ would result in a contradiction.

[26] In (43-e) I leave open how exactly the presupposition triggered by **only** projects through the quantifier—a tricky problem that is empirically not very well understood—and only give the truth conditions.

c. $[\![$**1 [only [t$_1$ did some of the problem sets]]**$]\!]^{c,w}$

$$= \lambda x_e. \begin{cases} 1 & \text{iff } x \text{ did at least one problem set in } w \wedge \neg[x \text{ did all of the problem sets in } w] \\ 0 & \text{iff } x \text{ did all of the problem sets in } w \\ \# & \text{iff } x \text{ did not do any of the problem sets in } w \end{cases}$$

d. $[\![(43\text{-a})]\!]^{c,w} = 1$ iff $|\{x : x \text{ is a student in } w \wedge x \text{ did at least one problem set in } w \wedge \neg[x \text{ did all of the problem sets in } w]\}| \geq \frac{1}{2}|\{x : x \text{ is a student in } w\}|$

e. 'Half of the students are such that they did some, but not all of the problem sets.' TRUE in (42)

(44) unavailable interpretation with wide-scope **only**

a. **[only [[half of the students] [1 [t$_1$ did some of the p-sets]]]]**

b. $ALT_c($**[half of the students] [1 [t$_1$ did some of the p-sets]]**$)$
$= \{$**[half of the students] [1 [t$_1$ did some of the p-sets]],**
[half of the students] [1 [t$_1$ did all of the p-sets]]$\}$

c. $[\![(44\text{-a})]\!]^{c,w}$

$$= \begin{cases} 1 & \text{iff } |\{x : x \text{ is a student in } w \wedge x \text{ did at least one problem set in } w \geq \frac{1}{2}|\{x : x \text{ is a student in } w\}| \\ & \wedge|\{x : x \text{ is a student in } w \wedge x \text{ did all of the problem sets in } w\}| < \frac{1}{2}|\{x : x \text{ is a student in } w\}| \\ 0 & \text{iff } |\{x : x \text{ is a student in } w \wedge x \text{ did all of the problem sets in } w\}| \geq \frac{1}{2}|\{x : x \text{ is a student in } w\}| \\ \# & \text{iff } |\{x : x \text{ is a student in } w \wedge x \text{ did at least one problem set in } w < \frac{1}{2}|\{x : x \text{ is a student in } w\}| \end{cases}$$

d. 'Half of the students did some of the problem sets, and it is not the case that half of the students did all of the problem sets.' NOT TRUE in (42)

- It is hard to make sense of readings of this type in a framework that only considers competition between the root sentence and its stronger alternatives, and does not allow subsentential constituents to compete with their alternatives.

2.3 *The grammatical approach to scalar strengthening*

- While **only/just** doesn't have exactly the same distribution as covert strengthening, we'll see there are striking similarities in the alternative sets they access (see e.g. Fox & Katzir 2011).
- The analogy goes further: These is a substantial literature arguing that even regular scalar inferences can be computed in embedded environments. [27]
- For instance, the 'not all' inference we computed above for **only some** in the scope of **half** is still possible without **only**, especially if the scalar item is narrowly focused:

(45) **Half of the students did all the problem sets, and half of them did SOME of the problem sets.** TRUE in (42)
✓Are you saying half of the students did some of the problem sets but not all?

- This suggests that there is a silent operation that has a semantic effect similar to **only**, and can apply to subsentential constituents[28]

[27] See Chemla & Spector (2011) for a classic paper on the subject and Gotzner & Benz (2022), Bassi et al. (2021) for readings that are stronger than standard approaches to embedded scalar inferences predict, but also require embedded strengthening.

[28] For a survey of the earlier literature arguing for this, see e.g. Chierchia et al. (2012); see also Sauerland (2004) for discussion of cases that seem at first sight to support embedded inferences, but on closer inspection do not. Recently some arguments have emerged that while embedded strengthening is possible, the assump-

- Standard implementation: covert operator **exh** that is like **only** except that the prejacent is asserted, not presupposed[29]

(46) Semantic rule for **exh** [to be revised]
$[\![\textbf{exh }\phi]\!]^{c,w} = 1$ iff $[\![\phi]\!]^{c,w} = 1$
$\wedge \forall \psi \in ALT_c(\phi)[[\![\phi]\!]^c \not\subseteq [\![\psi]\!]^c \rightarrow [\![\psi]\!]^{c,w} \neq 1]$

  - according to (46), for **exh** ϕ to be true, ϕ must be true and its alternatives from $ALT_c(\phi)$ cannot be true (unless they are entailed by ϕ)
  - for **exh** ϕ to be false, ϕ must be false
  - if neither of these holds, **exh** ϕ is a presupposition failure

- The embedded strengthening example (45) can then be given an LF with embedded **exh**

(47) **[half of the students] [1 [exh [$\mathbf{t_1}$ did some of the p-sets]]]**

(48) $[\![$**1 [exh [$\mathbf{t_1}$ did some of the p-sets]]**$]\!]^{c,w} = \lambda x.x$ did at least one problem set in $w \wedge \neg[x$ did all of the problem sets in $w]$

- This motivates a mechanism that derives scalar inferences in semantic composition without reasoning about speaker beliefs or utterances the speaker didn't make[30]
- We could then, in principle, assume that this mechanism also applies to root sentences and is the source of *all* scalar inferences.

(52) $[\![$**exh [Paul did some of the p-sets]**$]\!]^{c,w}$
$$= \begin{cases} 1 & \text{iff Paul did some of the problem sets in } w \\ & \wedge\neg[\text{Paul did all of the problem sets in } w] \\ 0 & \text{otherwise} \end{cases}$$

- Another potential advantage of this approach is that it straightforwardly accounts for scalar inferences triggered by alternatives that are not logically stronger, as in the **MA/PhD** case.

  exh ignores alternatives that are entailed by the prejacent, but negates both stronger and logically independent alternatives.

- However, there are also some new problems that don't arise for the neo-Gricean approach.

  One problem: Now that we've implemented a mechanism for scalar inferences, what about the systematic parallelism with uncertainty inferences?

- One possibility (Meyer 2013, 2014): Uncertainty inferences are also due to **exh**
  - Uncertainty inferences result independently when we strengthen above epistemic modal operators

[29] Recent work by Bassi et al. (2021), del Pinal et al. (2024) argues that there are advantages to a semantics for **exh** in which the scalar inference itself—the negation of the alternatives—is presupposed:
$$[\![\textbf{exh }\phi]\!]^{c,w} = \begin{cases} 1 & \text{iff } [\![\phi]\!]^{c,w} = 1 \\ & \wedge\forall\psi \in ALT_c(\phi)[[\![\phi]\!]^c \not\subseteq [\![\psi]\!]^c \\ & \rightarrow [\![\psi]\!]^{c,w} = 0] \\ 0 & \text{iff } [\![\phi]\!]^{c,w} = 0 \\ \# & \text{otherwise} \end{cases}$$
This brings the grammatical approach closer to Grice's and Horn's original intuition that scalar inferences are not asserted content, and also has other empirical advantages. In this class I will be using the non-presuppositional meaning for **exh**, but this is only for simplicity.

[30] Another argument for embedded strengthening comes from *Hurford disjunctions*, disjunctions in which there is an entailment (or contextual entailment) relation between the disjuncts. This configuration generally leads to oddness (cf. e.g. (49)), but becomes acceptable if the weaker disjunct by itself is capable of triggering a scalar inference that the stronger disjunct is false (50).

(49) **#Ann has children or she has three children.**

(50) **Paul did some or all of the problem sets.**

As Chierchia et al. (2012) point out, if there is a general constraint against entailment between the disjuncts of a disjunction (cf. also Katzir & Singh 2014), this constraint can be obviated in (50) if we are allowed to embed **exh** to compute a 'some but not all'-reading for the first disjunct.

(51) **[exh [Paul did some of the p-sets]] [or [Paul did all of the p-sets]]**

That said, many other factors influence the acceptability of HDs, which complicates this argument (see e.g. Hénot-Mortier 2025, Kalomoiros et al. to appear, Haslinger 2024).

(53) Mary: **Did Paul do all of the problem sets?**
Jane: **I only know that he did some of them.**
⇝ Mary is not certain that he did all of them

- Meyer (2013, 2014): LFs of declarative sentences contain a covert epistemic modal **K**; uncertainty is the result of **exh** (≈ **only**) applying above **K** (≈ **I know**)

(54) **exh [K [Paul did some of the problem sets]]**

- Another possibility (Fox 2014): mixed theory with two mechanisms for deriving scalar inferences
  - grammatical approach with **exh** for scalar inferences
  - neo-Gricean reasoning for uncertainty inferences[31]
  - Problem: unclear why the constraints on alternatives are so parallel for both phenomena

[31] Motivation: In some contexts where it is cooperative for the speaker to not reveal all their information (i.e. to violate Quantity), we don't find uncertainty inferences, but scalar inferences persist.

- From now on, I will mostly assume a grammatical theory of strengthening because it is more general and allows us to skip the explicit reasoning about speaker beliefs
- But the phenomena to be discussed will mostly carry over to the neo-Gricean approach, so feel free to 'fill in' neo-Gricean reasoning

2.4 *Presupposition strengthening*

- The general pattern that a basic meaning is strengthened by negating alternatives is not specific to optional implicatures, but found in various domains of human language.
- We've already seen this with **only/just**, let's briefly look at another example, PRESUPPOSITION STRENGTHENING.
- Presupposition-triggering items often have alternatives which seem, at first sight, to have complementary presuppositions:

(55) uniqueness presupposition of singular definites
a. #**I don't want to listen to the current US senator.**
b. ✓**I don't want to listen to a current US senator.**

(56) non-uniqueness inference of singular indefinites
a. ✓**I don't want to listen to the current US president.**
b. #**I don't want to listen to a current US president.**

(57) duality presupposition of **both**
a. #**John broke both of his fingers.**
b. ✓**John broke both of his arms.**

(58) anti-duality inference of **all**
a. ✓**John broke all of his fingers.**

b. #**John broke all of his arms.**

(59) participant presuppositions of local person pronouns

a. **I_2 have to leave now.** $\rightsquigarrow g_c(2)$ is the speaker
b. **You_2 have to leave now.** $\rightsquigarrow g_c(2)$ is the hearer

(60) non-participant inferences of 3rd person pronouns
He_2 has to leave now. $\rightsquigarrow g_c(2)$ is not the speaker or the hearer

- This pattern is so widespread that it would be a mistake to encode all these inferences lexically. Instead it looks like another systematic mechanism for strengthening with alternatives.
  - For the (in)definiteness case, Heim (1991) proposed that the non-uniqueness inference of indefinites is not a standard presupposition.
  - Instead, it is the result of competition with the definite—an inference that the context is not such that the presupposition of the definite would be met, an ANTI-PRESUPPOSITION.
  - For extensions to a range of other phenomena, see e.g. Sauerland (2008a,b), Percus (2006).
- One piece of evidence that anti-presuppositions are not on a par with regular presuppositions comes from embedding under **every** (Sauerland 2008a).

  In many such pairs, one presupposition "projects universally"—it has to be true for each entity in the restrictor of the **every**-phrase—while the other presupposition seems to give rise to an existential condition.[32]

[32] In the case of person features, this test does not work due to the indexicality of person features, but there are other diagnostics that support the view that the 3rd person is underlyingly non-presuppositional, e.g. its use in semantically 2nd person honorifics (see e.g. Sauerland 2008b, Wang 2025).

(61) SCENARIO: Half of the professors are supervising only one student. The others are supervising several students.

a. ??**[Every professor]$_1$ is going to nominate the student they$_1$ are supervising for the best paper award.**
b. ✓**[Every professor]$_1$ is going to nominate a student they$_1$ are supervising for the best paper award.**

(62) SCENARIO: Half of the cat owners own two cats; the others own three or more.

a. #**[Every cat owner]$_1$ has to vaccinate both of her$_1$ cats.**
b. ✓**[Every cat owner]$_1$ has to vaccinate all her$_1$ cats.**

- Similarly, there are asymmetries in case the speaker is epistemically uncertain as to which of the two presuppositions holds.

(63) SCENARIO: The speaker does not know whether Ann is supervising just one student or more than one.

a. ??**Ann is going to nominate the student she is supervising for the best paper award.**
b. ✓**Ann is going to nominate a student she is supervising for the best paper award.**

(64) SCENARIO: The speaker does not know whether Ann owns exactly two cats or more than two.

a. #**Ann has to vaccinate both of her cats.**
b. ✓**Ann has to vaccinate all her cats.**

It is often claimed that this test does not apply to person features, but maybe (65) is a relevant case.

Thanks to Margaret Wang for suggesting this type of example.

(65) SCENARIO: Ann found a letter from 30 years ago and is not sure whether she herself wrote the letter or whether it was one of her siblings.
Ann: **I'm not sure who wrote this letter, but one thing is clear . . .**

a. #**. . . my handwriting is gorgeous!**
b. ✓**. . . their handwriting is gorgeous!**

Q *Can you think of other pairs of expressions in your native language(s) that show these asymmetries wrt.* ***every*** *and epistemic uncertainty?*

- To make sense of this pattern, we need to recall a common assumption about the pragmatics of presuppositions, sometimes known as STALNAKER'S BRIDGE PRINCIPLE (see e.g. Stalnaker 2002 [1978]).
  - A context c provides a CONTEXT SET C_c. This contains exactly those possible worlds that are compatible with everything that is COMMON GROUND in c—roughly everything that is assumed to be common knowledge between speaker and hearer(s) in c.
  - A declarative sentence ϕ can be felicitously uttered in c only if there is no world in C_c in which $[\![\phi]\!]^{c,w} = \#$.

Recall that I use # to denote a third truth value that indicates presupposition failure.

- Given this picture, the above data pattern is expected if
  - regular presuppositions triggered during the semantic derivation project universally
  - indefinites, **all**, etc. are not regular presupposition triggers
  - there is a pragmatic principle that results in infelicity for a sentence if it has a contextually equivalent alternative with a stronger presupposition and that presupposition is met
- It's not completely clear how best to integrate this principle into a neo-Gricean pragmatic theory, in particular whether it should be thought of as falling under Quantity or Manner.

Here is a simple version of such a principle.[33]

(66) MAXIMIZE PRESUPPOSITION! [MP; adapted with changes from Sauerland 2008a]
Given an utterance context c with a cooperative speaker s_c and two LFs ϕ and ψ such that

a. $\forall w \in C_c.[\![\phi]\!]^{c,w} = [\![\psi]\!]^{c,w}$
(i.e. ψ and ϕ are contextually equivalent)

[33] Percus (2006) and Sauerland (2008a) discuss cases in which presupposition strengthening occurs in embedded positions. These are not captured by the neo-Gricean principle in (66). This probably motivates a grammatical mechanism similar to the **exh** operator for MP, an issue I leave open here.
Typically the strength relation in (66-c) is taken to involve a comparison of sets of worlds, not of world-context pairs. It seems to me that the context component is necessary to deal with things like presuppositions of indexical pronouns, which are usually taken to depend on the context rather than the facts of the evaluation world (cf. Zimmermann 1991).

b. and $\forall w \in C_c.[\![\phi]\!]^{c,w} \neq \# \wedge [\![\psi]\!]^{c,w} \neq \#$
(i.e. the common ground entails the presuppositions of both ϕ and ψ)

c. and $\{\langle c, w\rangle : [\![\psi]\!]^{c,w} = \#\} \supset \{\langle c, w\rangle : [\![\phi]\!]^{c,w} = \#\}$
(i.e. ψ has a strictly stronger presupposition than ϕ)

d. and $\psi \in ALT_c(\phi)$

then s_c will prefer uttering ψ over uttering ϕ.

- Let's illustrate with **both** and **all**. The compositional system produces the following meanings:

(67) a. $[\![$**John broke both of his arms**$]\!]^{c,w}$

$$= \begin{cases} 1 & \text{iff John has exactly two arms in } w \\ & \wedge \text{ John broke every arm he has in } w \\ 0 & \text{iff John has exactly two arms in } w \\ & \wedge \text{ at least one of John's arms was not broken in } w \\ \# & \text{iff John does not have exactly two arms in } w \end{cases}$$

(68) a. $[\![$**John broke all of his arms**$]\!]^{c,w}$

$$= \begin{cases} 1 & \text{iff John broke every arm he has in } w \\ 0 & \text{iff at least one of John's arms was not broken in } w \end{cases}$$

- The oddness of (68) then follows from MP:

  - The judgment that (68) is odd relies on a context where it is common ground that John has only two arms.
  - In such a context, C_c only contains worlds in which (67) and (68) have the same truth value, i.e. (67) and (68) are contextually equivalent.
  - Since (67) has a stronger presupposition than (68), (66) then requires a cooperative speaker to choose (67) over (68).

- The asymmetries wrt. epistemic uncertainty also follow from MP:

(69) Scenario: The speaker does not know whether Ann owns exactly two cats or more than two.

a. #**Ann has to vaccinate both of her cats.**

b. ✓**Ann has to vaccinate all her cats.**

  - In this scenario, C_c contains worlds in which Ann owns more than two cats. In such a world w, $[\![(69\text{-a})]\!]^{c,w} = \#$.
  - So (69-a) is bad in c due to Stalnaker's bridge principle, while (69-b) satisfies Stalnaker's bridge principle.
  - MP only applies if Stalnaker's bridge principle is satisfied for both alternatives[34] (see (66-b)) and therefore fails to block (69-b).

[34] There is some evidence that this precondition for blocking effects due to stronger presuppositions is too strong; see e.g. Anvari (2018, 2019).

3 *The need for constraints on alternatives*

- We have encountered three strengthening phenomena in natural language:
  - scalar inferences
  - strengthening triggered by exhaustifiers like **only** or **just**
  - presupposition strengthening
- By stating all three strengthening mechanisms in terms of the alternative-selection function ALT_c, I have been implicitly assuming that the way the alternatives are selected is the same for all these phenomena.[35]
- One reason to believe this is that the three phenomena seem to be subject to similar constraints on the alternative set $ALT_c(\phi)$.
- Specifically, it seems that the *syntactic form of the alternative* plays a role in constraining $ALT_c(\phi)$.
- Unless we somehow constrain $ALT_c(\phi)$, the theories of strengthening we have looked at all predict *strengthening inferences that are intuitively impossible*.
- Let's illustrate this with the scalar inference of **some**:
  - Substituting **all** for **some** leads to the attested 'not all' inference.

(70) a. $[_{\phi'}$ **exh** $[_{\phi}$ **Paul did some of the p-sets**$]]$
b. $ALT_c(\phi)$ = {**Paul did some of the p-sets**, **Paul did all of the p-sets**}
c. $[\![\phi']\!]^{c,w} = 1$ iff Paul did some of the p-sets in w $\wedge\neg$[Paul did all of the p-sets in w]

  - But if $ALT_c(\phi)$ is unconstrained, we can also choose an alternative based on **some but not all** and get 'some' to mean 'all':

(71) a. $[_{\phi'}$ **exh** $[_{\phi}$ **Paul did some of the p-sets**$]]$
b. $ALT_c(\phi)$ = {**Paul did some of the p-sets**, **Paul did some but not all of the p-sets**}
c. $[\![\phi']\!]^{c,w} = 1$ iff Paul did some of the p-sets in w $\wedge\neg$[Paul did some but not all of the p-sets in w] = 1 iff Paul did all of the p-sets in w.

  - There is a clear asymmetry here: The alternative set in (71-b) seems unavailable.

(72) CONTEXT: The syllabus says that students who pass the exam get an A if they also did all of the problem sets, and a B if they did some, but not all of the problem sets.
Jane: **So what about Paul? What grade will he get?**
Mary: <u>**Paul did some of the problem sets**</u> **and he passed the exam.**

[35] For scalar inferences and **only**, this claim is defended e.g. in Fox & Katzir 2011. For Maximize Presupposition, it is rarely explicitly discussed (however, see Rouillard & Schwarz 2017, Aravind 2018), but I think it is the default assumption in the literature on MP.

✓ Jane: **Are you saying he did not do all the problem sets and he's getting a B?**
× Jane: **Are you saying he did all the problem sets and he's getting an A?**

- Most other scalar inferences show the same pattern; consider e.g. **warm**:[36]

(73) Context: Mary and Jane are baking bread and need 1l of hot water.
Jane: **What's the temperature of the water?**
Mary: **The water is warm.**
a. ✓ Jane: **Are you saying that it's warm but not hot and we can't use it yet?**
b. × Jane: **Are you saying it's hot and we can use it already?**

– The attested inference is derived by substituting **hot** for **warm**:

(74) a. [$_{\phi'}$ **exh** [$_{\phi}$ **the water is warm**]]
b. $ALT_c(\phi)$ = {**the water is warm**, **the water is hot**}
c. $[\![\phi']\!]^{c,w} = 1$ iff the temperature of the water in $w > d^c_{\textbf{warm}}$ $\wedge$the temperature of the water in $w \leq d^c_{\textbf{hot}}$

– But if $ALT_c(\phi)$ is unconstrained, we should be able to get **warm** to mean **hot** by introducing an alternative based on **warm but not hot**:

(75) a. [$_{\phi'}$ **exh** [$_{\phi}$ **the water is warm**]]
b. $ALT_c(\phi)$ = {**the water is warm**, **the water is warm and the water is not hot**}
c. $[\![\phi']\!]^{c,w} = 1$ iff the temperature of the water in $w > d^c_{\textbf{hot}}$

- Strengthening with **only/just** systematically shows the same asymmetries in those cases where it is acceptable to begin with.[37]

(76) Context: The syllabus says that students who pass the exam get an A if they also did all of the problem sets, and a B if they did some, but not all of the problem sets.
Jane: **So what about Paul? What grade will he get?**
Mary: **Paul did only some of the problem sets and he passed the exam.**
✓ Jane: **Are you saying he did not do all the problem sets and he's getting a B?**
× Jane: **Are you saying he did all the problem sets and he's getting an A?**

- Presupposition strengthening also gives rise to related asymmetries. For instance, substituting **both** for **all** can (and in fact must) count as an alternative of **all**, but substituting e.g. **all three** cannot.[38]

(77) Context: It is common knowledge that Ann has exactly two cats.

[36] The case of **allowed** is more tricky, because the focus alternatives of other elements in the scope of **allowed** can sometimes give rise to what looks like a strengthening of **allowed** to **required**. We will return to this issue later this week.

[37] This is part of Fox & Katzir's (2011) motivation for their claim that we should look for a unified theory of alternatives for scalar inferences and items like **only**.

[38] For the point that MP appears to be insensitive to alternatives obtained by adding a numeral, see Rouillard & Schwarz (2017) and Aravind (2018:§4.5.2).

a. ✓**Ann has to vaccinate both of her cats.**
b. #**Ann has to vaccinate all of her cats.**

(78) attested strengthening

a. ALT_c(**Ann has to vaccinate all of her cats**)
= {**Ann has to vaccinate all of her cats, Ann has to vaccinate both of her cats**}
b. anti-presupposition: $\exists w \in C_c$.Ann does not have exactly two cats in w

(79) CONTEXT: It is widely known that Ann has exactly three cats.

a. ✓**Ann has to vaccinate all three of her cats.**
b. ✓**Ann has to vaccinate all of her cats.**

(80) unattested strengthening

a. ALT_c(**Ann has to vaccinate all of her cats**)
= {**Ann has to vaccinate all of her cats, Ann has to vaccinate all three of her cats**}
b. anti-presupposition: $\exists w \in C_c$.Ann does not have exactly three cats in w

- A similar point can be made about singular indefinites. We seem to only find MP effects based on alternatives with singular definites that presuppose uniqueness:

(81) CONTEXT: It is common knowledge that Ann is supervising only one student.

a. ✓**Ann is going to nominate the student she is supervising for the best paper award.**
b. ??**Ann is going to nominate a student she is supervising for the best paper award.**

(82) attested strengthening

a. ALT_c(**Ann is going to nominate a student she is supervising**)
= {**Ann is going to nominate a student she is supervising, Ann is going to nominate the student she is supervising**}
b. anti-presupposition: $\exists w \in C_c$.Ann is not supervising exactly one student in w

But there are also potential alternatives that presuppose non-uniqueness and do not give rise to MP effects:

(83) CONTEXT: It is common knowledge that Ann is supervising many students.

a. ✓**Ann is going to nominate one of the many students she is supervising for the best paper award.**
b. ✓**Ann is going to nominate a student she is supervising for the best paper award.**

(84) unattested strengthening

a. ALT_c(**Ann is going to nominate a student she is supervising**)
= {**Ann is going to nominate a student she is supervising, Ann is going to nominate one of the many students she is supervising**}
b. inference: $\exists w \in C_c$.Ann is not supervising many students in w

- A pervasive idea in the literature, going back at least to Horn (1972), is that we should block these unattested cases by ruling out alternatives that are *structurally more complex* than the prejacent expression.

(85) Upper bound hypothesis
$ALT_c(\phi)$ can only contain expressions whose structural complexity does not exceed that of ϕ.

- This idea seems to straightforwardly account for the contrasts we've seen so far.

prejacent	alternative
Paul did some of the p-sets	✓**Paul did all of the p-sets** # **Paul did (some but) not all of the p-sets**
you are allowed to present a poster	✓**you are required to present a poster** # **you are (allowed but) not required to present a poster**
the water is warm	✓**the water is hot** # **the water is (warm but) not hot**
Ann has to vaccinate all of her cats	**Ann has to vaccinate both of her cats** # **Ann has to vaccinate all three of her cats**
Ann is going to nominate a student she is supervising	✓**Ann is going to nominate the student she is supervising** # **Ann is going to nominate one of the many students she is supervising**

4 *The symmetry problem*

To sharpen the puzzle raised by unavailable strengthenings such as **some** ⇝ 'all', it is useful to situate it within a wider class of cases in which two relevant alternatives *'block each other'* from being excluded.

4.1 *Partitions and relevance*

- We assumed that $ALT_c(\phi)$ can contain only alternatives *relevant* to the question under discussion Q_c.
- In support of this, note that the strength of a scalar inference can be manipulated by making additional alternatives relevant:

(86) Context: The syllabus says that students who pass the exam get an A if they also did all of the problem sets, a B if they did at least half, but not all of the problem sets, and a C if they did some of the problem sets but less than half. Students who didn't do any problem sets get a D, and students who didn't pass the exam get an F.
Jane: **So what about Paul? What grade will he get?**
Mary: **Well, Paul passed the exam and he did some of the problem sets.**

Jane: **Are you saying he did less than half of the problem sets and will get a C?**

(87) ALT_c(**Paul did some of the problem sets**)
= {**Paul did some of the problem sets**,
Paul did half of the problem sets,
Paul did all of the problem sets}

- In addition, if we set up a QUD for which it absolutely does not matter whether a certain stronger alternative is true or not, no scalar or uncertainty inference based on this alternative will be derived:

(88) CONTEXT: An exam comes with three bonus questions. Every student who gets 80% of the regular questions right gets an A if they answered some of the bonus questions and a B otherwise. Mary has a grading sheet that has a 'yes' or 'no' column indicating whether a student got at least one bonus question right, since the exact number of bonus questions they answer won't affect their grade.
Jane: **So what about Paul? What grade will he get?**
Mary: [checks notes] **Well, Paul got 85% of the regular questions right and <u>he answered some of the bonus questions</u>, so he's getting an A.**
$\not\rightsquigarrow$ Paul did not answer all of the bonus questions

(89) CONTEXT: Some taxpayers are not allowed to submit their tax return online, some are allowed to but do not have to, and some have to submit it online. Peter calls the tax office to find out whether he can submit his tax return online. The official checks the prerequisites in his database and says:
<u>You are allowed to submit your tax return online.</u>
$\not\rightsquigarrow$ Peter is not required to submit his return online

- This suggests a naive theory of alternatives along the following lines:

(90) $ALT_c(\phi)$ contains all and only those sentences that are RELEVANT to Q_c, the implicit QUD in c.

- To define relevance, we need to be a bit more precise about what we take a QUD to be.
  - Most of the literature on alternatives assumes a relatively minimal model of the QUD on which it provides a PARTITION of the context set C_c, following Groenendijk & Stokhof (1984) and Lewis (1988).[39]

    (91) A PARTITION of a set S is a set P such that
    a. every element of P is a nonempty proper subset of S
    b. $\bigcup P = S$
    c. any two sets in P are disjoint

[39] Recall: The context set is the set of those possible worlds compatible with all the information that is common ground in c, i.e. that is assumed to be common knowledge among all the conversational participants in c.

– For instance, given the variant of the grading context in (86) we get the following partition:

(92) $\{S_A, S_B, S_C, S_D, S_F\}$ where $S_A = \{w \in C_c$: Paul will get an A in $w\}$ etc.

Mary's assertion **Paul passed the exam** results in a new context set which no longer contains any worlds in S_F

– Similarly, if only two students, Paul and Mary, took the exam, the question **Who passed the exam?** corresponds to the following partition.[40]

(93) $\{\{w \in C_c$: John and Mary passed in $w\}$,
$\{w \in C_c$: John, but not Mary passed in $w\}$,
$\{w \in C_c$: Mary, but not John passed in $w\}$,
$\{w \in C_c$: neither John nor Mary passed in $w\}\}$

[40] Note that on this partition-based view, questions are represented as sets of propositions, but these are not the same sets produced by alternative-based approaches to interrogative semantics (Hamblin 1973, Karttunen 1977): The sets produced by Hamblin's and Karttunen's systems may in general contain overlapping propositions, but there can be no overlap in a partition.
One simple way of obtaining a partition from a set S of propositions is as follows: For any world $w \in C_c$, the partition class $[w]$ is obtained as $\{w' \in C_c : \forall p \in S. p(w') = 1 \leftrightarrow p(w) = 1\}$, i.e. the set of all worlds satisfying all and only those propositions from S that are true in w.

- Given a QUD Q viewed as a partition, a natural view of relevance might be that a proposition is relevant to Q iff it is incompatible with at least one partition cell.

– But for the purposes of strengthening, this won't work.

– Consider a sentence ϕ and its stronger alternative ψ (e.g. ϕ = **Paul did some of the problem sets** and ψ = **Paul did all of the problem sets**).

– Since ψ is stronger than ϕ, any partition cell of Q incompatible with ψ is also incompatible with ϕ.

– So ψ is predicted to be relevant whenever ϕ is relevant, and relevance will not impose an actual constraint on strengthening.

- As we saw in (88) and (89), it is possible to make a stronger alternative irrelevant by manipulating the QUD.

– Intuitively, in these cases, the alternative is OVERINFORMATIVE—the extra information it provides does not help us eliminate a partition call of the QUD.

– The following notion of relevance allows us to make sense of the notion of an overinformative alternative.[41]

(94) a. A proposition p is RELEVANT to a QUD Q based on a context set C iff there is a set $S \subset Q$ of partition cells such that $\bigcup S = \{w \in C : p(w) = 1\}$.
b. A sentence ϕ is relevant in a context c iff the proposition $\lambda w.[\![\phi]\!]^{c,w}$ is relevant to Q_c.

(94) says that a relevant proposition is a (non-tautologous) proposition that makes no distinctions between worlds in the context set that are not distinguished by the QUD.

[41] Except for the relativization to the context set, this notion of strong relevance is called 'strong relevance' by Križ & Spector (2021). It corresponds to Lewis's (1988) notion of a statement being 'entirely about a subject matter', except for tautologies, which are not relevant according to (94-a) but would count as being 'about' every subject matter for Lewis (1988). Note that the notion of strong relevance is too restrictive to match our intuitions about what counts as a 'relevant' answer in a question-answer sequence; for a recent hypothesis on this mismatch, see e.g. Benbaji & Doron (in progress).

- To illustrate, consider the strengthening of **some** in (95) again:

(95) CONTEXT: The syllabus says that students who pass the exam get an A if they also did all of the problem sets, a B if they did at least half, but not all of the problem sets, and a C if they did some of the problem sets but less than half, and a D otherwise.
Jane: **So what about Paul? What grade will he get?**
Mary: **Well, Paul passed the exam and he did some of the problem sets.**

Assume that the context set C_c encodes all the information mentioned in (95) as well as the content of Mary's assertion **Paul passed the exam**. If so, the question **What grade will he get?** induces the partition $Q_c = \{S_A, S_B, S_C, S_D\}$.

Restricted to this context set, the alternatives based on **some, half** and **all** all exactly correspond to a union of partition cells:

(96) a. $\{w \in C_c : [\![\textbf{Paul did some of the problem sets}]\!]^{c,w} = 1\} = S_A \cup S_B \cup S_C$
b. $\{w \in C_c : [\![\textbf{Paul did half of the problem sets}]\!]^{c,w} = 1\} = S_A \cup S_B$
c. $\{w \in C_c : [\![\textbf{Paul did all of the problem sets}]\!]^{c,w} = 1\} = S_A$

In particular, none of them assigns different truth values to two worlds in C_c in which Paul gets the same grade.

So they are all relevant and expected to be available for strengthening.

- In contrast, consider the context in (97), in which no strengthening of **some** takes place:

(97) CONTEXT: An exam has three bonus questions at the end. Every student who gets 80% of the regular questions right gets an A if they answered some of the bonus questions and a B otherwise. The exact number of bonus questions won't affect their grade. Mary has a grading sheet that has a 'yes' or 'no' column indicating whether a student got at least one bonus question right.
Jane: **So what about Paul? What grade will he get?**
Mary: [checks notes] **Well, Paul got 85% of the regular questions right. He answered some of the bonus questions, so he's getting an A.**

If C_c that entails Paul got 85% of the regular questions right, the **some**-sentence is relevant because it picks out a single complete partition cell:

(98) $\{w \in C_c : [\![\textbf{Paul answered some of the bonus questions}]\!]^{c,w} = 1\} = S_A$

The **all**-alternative, however, picks out a proper subset of this partition cell and is therefore overinformative.

(99) $\{w \in C_c : [\![\textbf{Paul answered all of the bonus questions}]\!]^{c,w} = 1\} \subset S_A$

It therefore counts as irrelevant and is not available for strengthening.

4.2 *Symmetric alternatives*

- In sum, it seems like we want to constrain alternatives in the following way:

(100) For any context c and any sentence ϕ that is relevant in c:
$ALT_c(\phi) \subseteq \{\psi : \psi \text{ is a well-formed structure of type } t \wedge \psi \text{ is relevant in } c\}$

- But even disregarding the 'impossible strengthenings' of the **some** ⇝ 'all' type, we find a set of cases in which (100) overgenerates.
- The relevant cases are such that there are *several relevant alternatives* that *cannot all be excluded at the same time*.
- Descriptively, in such cases no scalar inference is derived; instead we get an obligatory ignorance inference—it's as if the different options for scalar strengthening block each other (Fox 2007).

(101) Mary: **Paul is going to Canada or the US.**
a. ⇝ Mary is not certain that Paul is going to Canada and not certain that Paul is going to the US
✓ **Are you saying that you don't know which of these countries he's going to?**
b. ⇝̸ Paul is not going to Canada
⇝̸ Paul is not going to the US
× **Are you saying that he's not going to Canada?**

(102) Mary: **Paul got at least two job offers.**
a. ⇝ Mary is not certain that Paul got exactly two job offers and not certain that he got more than two
b. ⇝̸ Paul did not get exactly two job offers
⇝̸ Paul did not get more than two job offers

A case without an entailment-based scale:

(103) Mary: **What city did Paul move to?**
Jane: **Well, <u>he moved to the US</u>.**
⇝ Mary does not know which US city Paul moved to
⇝̸ Paul didn't move to Boston, ⇝̸ Paul didn't move to DC, ...

- In each case there is a natural choice for the alternative set such that it is not possible to negate all of them without running into a contextual contradiction.

(104) a. {**Paul is going to Canada**, **Paul is going to the US**}
b. {**Paul got two job offers**, **Paul got at least three job offers**} [42]
c. {**Paul moved to Boston**, **Paul moved to DC**, ...} [listing all the cities in the US]

[42] Here I am assuming an upper-bounded meaning for the numeral **two**, on which it entails 'not more than two'. It is likely however, that this meaning is itself the result of strengthening, see e.g. Spector 2013.

– On the neo-Gricean approach, we generate an uncertainty inference ($\neg B_{w_c}(s)(\llbracket\psi\rrbracket^c)$) about each alternative ψ.
– It is then impossible to strengthen all of these into scalar inferences ($B_{w_c}(s)(\neg\llbracket\psi\rrbracket^c)$) without contradiction, i.e. the competence assumption leads to a contradiction.[43]
– On the grammatical approach, **exh** will create a contradiction directly.

[43] In fact, in (104-a) and (104-b) neither uncertainty inference can be strengthened without contradicting the other. In (104-c) it is technically possible to strengthen almost all of the uncertainty inferences into scalar inferences as long as there is still uncertainty about at least two of the inferences. It is not clear to me that this corresponds to an actual reading of the sentence though.

(105) $\llbracket$**exh [Paul is going to Canada or the US]**$\rrbracket^{c,w}$
= 1 iff $\llbracket$**Paul is going to Canada or the US**$\rrbracket^{c,w}$ = 1
∧ $\llbracket$**Paul is going to Canada**$\rrbracket^{c,w}$ = 0
∧ $\llbracket$**Paul is going to the US**$\rrbracket^{c,w}$ = 0

• Let's introduce some terminology to be able to talk about such situations[44]

[44] This is from Haslinger & Schmitt (to appear) and not standard terminology in the literature.

(106) A set S of propositions is CONSISTENTLY EXCLUDABLE given a prejacent p iff $\exists w.p(w) = 1 \wedge \forall q \in S.q(w) \neq 1$.

(107) Given a prejacent sentence ϕ, a set A of alternative sentences is SYMMETRIC iff $\{\llbracket\psi\rrbracket^c : \psi \in A\}$ is not consistently excludable given $\llbracket\phi\rrbracket^c$.

(108) Given a prejacent sentence ϕ, a set A of alternative sentences is a STALEMATE SET iff A is symmetric given ϕ and no proper subset of A is symmetric given ϕ.

– In the disjunction example (101), {**Paul is going to Canada**, **Paul is going to the US**} is a symmetric subset and a stalemate set.
– {**Paul is going to Canada**, **Paul is going to the US**, **Paul is going to Canada and the US**} is a symmetric subset, but not a stalemate set.

• The core observation we get from examples like (101), (102) and (103), then, is that in selecting $ALT_c(\phi)$ *we cannot choose arbitrarily from a stalemate set*.

– If the alternatives in a stalemate set are all relevant, we cannot derive a scalar inference by deciding to not include all of them in $ALT_c(\phi)$.
– At the same time, it's not like the strengthening mechanism is forced to consider all of them—in that case the result would be a feeling of contradiction, which doesn't seem to happen.

• An influential proposal by Fox (2007) accounts for this fact by assuming that

– the definition of $ALT_c(\phi)$ doesn't allow us to make arbitrary choices among relevant alternatives
– and the strengthening mechanism (**exh** for Fox) systematically ignores subsets of the alternatives that block each other.

Fox defines the notion of INNOCENTLY EXCLUDABLE (IE) alternatives. Given an alternative set S, an alternative is IE iff it is in every maximal consistently excludable subset of S:

(109) Given a prejacent proposition p and a set S of propositions, the set of INNOCENTLY EXCLUDABLE alternatives wrt. p in S is defined as:
$IE(p, S) = \{q \in S : \forall S' \subseteq S[[S' \text{ consistently excludable given } p \wedge \neg\exists S''[S' \subset S'' \subseteq S \wedge S'' \text{ consistently excludable given p}]] \rightarrow p \in S']\}$

(110) ALT_c(**Paul is going to Canada or the US**) =
{**Paul is going to Canada or the US**, **Paul is going to Canada**, **Paul is going to the US**, **Paul is going to Canada and the US**}
   a. maximal consistently excludable subsets:
   {**Paul is going to Canada**, **Paul is going to Canada and the US**}
   {**Paul is going to the US**, **Paul is going to Canada and the US**}
   b. not consistently excludable: {**Paul is going to Canada**, **Paul is going to the US**, **Paul is going to Canada and the US**}
   c. innocently excludable: **Paul is going to Canada and the US**
   d. not innocently excludable: **Paul is going to Canada**, **Paul is going to the US**

He then restricts the effect of **exh** so that only the innocently excludable alternatives are negated.[45]

[45] We can now drop the explicit condition that only alternatives that are not already entailed by ϕ get negated. If an alternative is entailed by ϕ, it cannot be in any consistently excludable set and is therefore not IE.

(111) semantic rule for **exh** (revised)
$[\![\textbf{exh } \phi]\!]^{c,w} = 1 \text{ iff } [\![\phi]\!]^{c,w} = 1 \wedge \forall\psi \in IE([\![\phi]\!]^c, \{[\![\psi]\!]^c : \psi \in ALT_c(\phi)\}).[\![\psi]\!]^{c,w} = 0$

(112) If ALT_c(**Paul is going to Canada or the US**) is defined as in (110):
$[\![$**exh [Paul is going to Canada or the US]**$]\!]^{c,w} = 1$ iff Paul is going to Canada or the US in w $\wedge$ Paul is not going to both Canada and the US in w

4.3 *No arbitrary choice between relevant alternatives*

- Note that to get these data right, it is crucial that we can't simply decide to exclude some alternative in the stalemate set from $ALT_c(\phi)$. Otherwise we would get unattested strengthened readings:

(113) ALT_c(**Paul is going to Canada or the US**) =
{**Paul is going to Canada or the US**, **Paul is going to Canada**,

Paul is going to Canada and the US$\}$

(114) If ALT_c(**Paul is going to Canada or the US**) is defined as in (110):
$[\![$**exh [Paul is going to Canada or the US]**$]\!]^{c,w}$
$=$ 1 iff Paul is going to Canada or the US in w
$\wedge$ Paul is not going to Canada in w
$\wedge$ Paul is not going to both Canada and the US in w
= 1 iff Paul is going to the US, but not to Canada in w

(115) ALT_c(**Paul got at least two job offers**) $=$
$\{$**Paul got at least two job offers, Paul got more than two job offers**$\}$

(116) If ALT_c(**Paul got at least two job offers**) is defined as in (110):
$[\![$**exh [Paul got at least two job offers]**$]\!]^{c,w}$
$=$ 1 iff Paul got two or more job offers in w
$\wedge$ Paul did not get more than two job offers in w
= 1 iff Paul got exactly two job offers in w

- So we now have a second set of phenomena where some of the logically possible strengthening options are ruled out.
- However, the nature of the restriction in the **some/all**-type cases was quite different:
  - Given our definition of relevance, whenever (117) is uttered in a context that makes (117-a) relevant, (117-b) is also relevant. [46]

    (117) **Paul answered some of the bonus questions.**
    a. **Paul answered all of the bonus questions.**
    b. **Paul answered some of the bonus questions and he did not answer all of the bonus questions.**

  - Further, (117-a) and (117-b) form a stalemate set given (117)—negating both of them would result in a contradiction.
  - So if both of them are included in $ALT_c(\phi)$, neither of them is going to denote a proposition that is innocently excludable given $[\![(117)]\!]^c$.
  - So it should not be possible to derive a scalar inference based on either of these alternatives.
  - We should only be able to derive the inference that the speaker is ignorant as to the truth value of (117-a). [47]
- More generally, as pointed out by Katzir (2007), basically any alternative that gives rise to an attested scalar inference has a 'partner' that it forms a stalemate set with, an issue known as the SYMMETRY PROBLEM.[48]

  The process of making a choice among the alternatives in a stalemate set to resolve this problem is often called SYMMETRY BREAKING.
- So the theoretical challenge is to deal with two types of cases in which we cannot choose arbitrarily from the relevant alternatives:

[46] Consider an arbitrary sentence ϕ with a stronger alternative ψ (which is still stronger when restricted to the context set), and assume ψ is relevant (e.g. ϕ = **some P Q**, ψ = **all P Q**.
Then $[\![\phi]\!]^c \cap C_c$ must be the disjunction of a proper subset S of the partition cells of Q_c and $[\![\psi]\!]^c \cap C_c$ must be the disjunction of a subset $T \subset S$.
But then $[\![\phi$ **and [not** ψ**]**$]\!]^c$ (e.g. **some P Q and not all P Q**) exactly picks out the disjunction of $S \backslash T$, and is therefore also relevant.

[47] Meyer (2014) claims that this inference is not actually available unless the Hurford disjunction **some or all** is used.

[48] Katzir (2007) credits Kroch (1972) with the original observation and attributes the term 'symmetry problem' to Kai von Fintel and Irene Heim.

- disjunction, **at least**, less specific/more specific place names etc.: $ALT_c(\phi)$ has to include either all or none of the alternatives in the stalemate set, i.e. symmetry can't be broken
- **some/all, warm/hot, allowed/required, a/the, all/both**, 3rd person/local person etc.:

  symmetry can be broken by including only one alternative in $ALT_c(\phi)$, but only in one way

prejacent	alternative
you are <u>allowed</u> to present a poster	✓ **you are <u>required</u> to present a poster**
	×**you are <u>(allowed but) not required</u> to present a poster**
the water is <u>warm</u>	✓ **the water is <u>hot</u>**
	×**the water is <u>(warm but) not hot</u>**

- A common idea that arguably goes back to the early work of Horn (1972) is that the difference between the two cases concerns the *structural complexity of the alternatives*.

  - If none of the alternatives in the stalemate set exceeds the prejacent in complexity, the symmetry cannot be broken.
  - If some alternatives in the stalemate exceed the prejacent in complexity, these alternatives are not included in $ALT_c(\phi)$ to begin with, so the symmetry problem does not arise.

  ⇒ $ALT_c(\phi)$ consists of *all* alternatives that are (i) relevant and (ii) satisfy a structural condition limiting their syntactic complexity relative to the prejacent.

- This idea has been implemented in its most general form in Katzir (2007), the paper that will be the starting point for the rest of this minicourse.

4.4 *Bonus problem: When can 'salience' break symmetry?*

- We have defined relevance in such a way that a stalemate set consisting of only two alternatives can never be broken up by appealing to relevance.

  For instance, whenever the prejacent (118) and the alternative (118-a) are relevant, (118-b) must also be relevant.

(118) **Paul answered some of the bonus questions.**
  a. **Paul answered all of the bonus questions.**
  b. **Paul answered some but not all of the bonus questions.**

- We have also assumed that, as long as it meets the structural complexity constraint, a relevant alternative has to be in $ALT_c(\phi)$.

- Apart from the fact that this makes it impossible to arbitrarily break symmetry in cases like disjunction and **at least**, it also has other advantages. For instance, it explains why Maximize Presupposition effects seem to be obligatory:

(119) a. ✓**John broke both of his arms.**
b. #**John broke all of his arms.**

  - Recall that presupposition strengthening requires contextually equivalent alternatives.[49]
  - In (119), contextual equivalence is met only if John has exactly two arms in every world in C_c.
  - For (119-b) to satisfy the Gricean Maxim of Relevance, it must express a proposition relevant to Q_c.
  - But since our definition of relevance in (94-a) is insensitive to the truth value of a proposition in worlds that are not in the context set, the contextual equivalence entails that (119-a) is relevant iff (119-b) is.
  - So in any context where (119-b) can be uttered by a cooperative speaker satisfying Relevance, (119-a) $\in ALT_c($(119-b)$)$.

- However, sometimes the context can introduce an asymmetry between a proposition and its negation, such that one counts as a 'good answer' to a question and the other does not.

  To avoid confusion with the partition-based use of the term RELEVANCE introduced above, I will refer to this as an asymmetry in SALIENCE.

- Hirsch (2024), Hirsch & Schwarz (2024) point out that there are some cases in which a difference in the salience of the two alternatives can break up a stalemate set. The following, a variant of an example from Trinh & Haida (2015), is a case in point.[50]

(120) CONTEXT: A doctor said that to stay healthy in old age, it is important to exercise regularly, meditate regularly and not smoke.
Mary: **So is Jane doing what the doctor recommended?**
Paul: **Well, she (only) exercises.**
⇝ Jane doesn't meditate, ⇝ Jane still smokes

  - To get both inferences, it seems we need to include an alternative containing a negation, which should be more complex than the non-negative prejacent

(121) $ALT_c($**Jane exercises**$) = \{$**Jane meditates, Jane doesn't smoke**$\}$

  - But this suggests that the context is able to break the symmetry in two stalemate sets:

(122) a. {**Jane smokes, Jane doesn't smoke**}
b. {**Jane meditates, Jane doesn't meditate**}

[49] Recall: Two sentences ϕ and ψ are contextually equivalent in c iff for every world w in the context set C_c, ϕ has the same truth value as ψ in w.

[50] Some cases of this kind in the literature seem to rely on the alternative being mentioned in the immediate discourse context, a factor that can overrule structural constraints on alternatives in general (see Katzir 2007, Trinh & Haida 2015) but as (120) shows, this doesn't seem to be necessary. Trinh & Haida (2015) propose an amendment of structural alternative constraints that can deal with some of these cases, but it is not general enough; see e.g. Breheny et al. (2018), Haslinger & Schmitt (to appear) for discussion. In particular, it can't deal with cases like (120) where the alternative is not explicitly mentioned by the speaker.

– The symmetry-breaking criterion here can't be a purely structural one, but must appeal to contextual knowledge because the stalemates in (122-a) and (122-b) are broken up in opposite ways.

(123) a. **Jane doesn't meditate**
b. **Jane smokes**

The alternatives in (123) are ruled out because not meditating and smoking are not recommended, and thus do not fall into a contextually salient 'natural class' with exercising.

– Note that this is not clearly about relevance, in the sense of ruling out certain cells in the partition induced by a question. (123-a) and (123-b) would both address Mary's question.

- Looking only at examples of this type, one might assume that the whole project of resolving symmetry via structural constraints is unmotivated.

Maybe stalemate sets within $ALT_c(\phi)$ are broken up by considering only alternatives in a contextually provided set of 'salient' propositions, and there is no need for an additional structural theory.[51]

- I think that this general conclusion is too strong. The cases of unavailable strengthening that we've discussed so far seemingly can't be overruled by constructing a salient 'natural class' that includes the prejacent and one of the alternatives in the stalemate set.

[51] This hypothesis is in fact entertained in Hirsch (2024) and Hirsch & Schwarz (2024). We will return to some of their other examples later and see that on closer inspection, the distribution of these cases supports modified structural theories. The case discussed here, though, is a genuine problem.

(124) CONTEXT: Jane got a grant this year. There are two rules concerning paperwork for these grants: First, one has to do paperwork if one spends some of the money in the first year. Second, there is extra paperwork if not all of the money is spent within a year.
The end of the year is approaching. Administrators Mary and Paul are preparing the paperwork for everyone.
Mary: **So, how much paperwork does Jane have to do?**
Paul: **Well, she (only) spent some of the money this year.**
$\not\rightsquigarrow$ Jane spent all the money and doesn't have to do the extra paperwork
$\rightsquigarrow$ Jane didn't spend all the money and has to do the extra paperwork

(125) $\times$ ALT_c(**she spent some of the money this year**)
$=$ {**she spent some of the money this year, she did not spend all of the money this year**}

(126) CONTEXT: Everyone with more than one child can claim a 'C-3 tax credit'. Everyone with more than two children can claim a 'C-4 tax credit'.
Mary and Jane are helping their friend Paul fill in a tax form. There is a line instructing the reader to claim the C-3 credit if they have more than one child, and another line instructing them to claim the C-4 credit if they have more than two children.

Mary: **So, can Paul get both of these tax credits?**
Jane: **Well, Paul has at least two children.**
$\not\rightsquigarrow$ Paul has exactly two children and can't claim the C-4 credit
$\rightsquigarrow$ Jane doesn't know whether Paul has more than two children and can claim the C-4 credit

(127) $\times$ ALT_c(**Paul has at least two children**)
= {**Paul has at least two children**, **Paul has more than two children**}

Q *The intuitively unavailable inferences in (126)/(127) improve under some manipulations of the crucial sentence as well as the preceding discourse context. Can you think of some variants of the examples that have the relevant inference?*

- More generally, I do not see how a theory based on salience could deal e.g. with the Maximize Presupposition examples, where the semantic differences between the prejacent and the alternatives are not even at issue and neither available nor unavailable cases must be salient.
- That said, Hirsch and Schwarz make a convincing case that salience matters in a subset of cases of symmetry breaking (*contra* Fox & Katzir 2011), and we lack a good characterization of this subset.
- This sets up a general theme of this mini-course:
  - Structure-based approaches to alternative constraints are very successful in some empirical domains
  - But there are also domains where they systematically break down, and we lack a good characterization of when this happens
  - In particular, it is often an open question whether the conditions under which this happens are themselves structural

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