Modal presupposition and probability-sensitivity of negated indefinites

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Outline

Oddness of negated indefinites

- Oddness arises from negated indefinites when their strengthened or exhaustified positive counterparts depict anomalous scenarios (Spector 2007, Farkas & de Swart 2010):

(1) Negated SG indefinites

a. Mary doesn't have blue eyes.
b.#Mary doesn't have a blue eye.

(2) Negated PL indefinites

a.#Frank doesn't have Roman noses.
b. Frank doesn't have a Roman nose.

Modal presupposition

- Such oddness has been described as a kind of **modal presupposition** failure (Spector 2007):

  (3) #Frank doesn't have Roman noses.
  $\rightsquigarrow$ Frank could have had multiple Roman noses.

  (4) #Frank doesn't have a blue eye.
  $\rightsquigarrow$ Frank could have had exactly one blue eye.

- These modal presuppositions cannot be supported by contexts compatible with common sense.

(Anti-)multiplicity inferences

- Intuitive connection between the oddness under negation and the inferences drawn from positive PL and SG sentences, i.e., **multiplicity** and **anti-multiplicity** inferences.

(5) Multiplicity
Frank has cars.
⇝ Frank has multiple cars.

(6) Anti-multiplicity
Frank has a car.
⇝ Frank has exactly one car.

(Anti-)multiplicity as scalar implicature

- It is widely accepted that these inferences are **scalar implicatures** (Spector 2007, Zweig 2009, Ivlieva 2013, Mayr 2015, Sudo 2023, Doron 2024, 2025).
- The puzzle is that scalar implicatures usually disappear under negation, but oddness persists.

(7) a. Frank doesn't have cars. $\rightsquigarrow$ Frank has zero cars.
b. Frank doesn't have a car. $\rightsquigarrow$ Frank has zero cars.

(8) a.#Frank doesn't have Roman noses.
b.#Frank doesn't have a blue eye.

In this talk we will

- introduce an approach based on presuppositional exhaustification + post-accommodation informativity (**PEX + PAI**);
- present an alternative analysis based on partition by exhaustification (**PBE**);
- present another phenomenon, the probability-sensitive preference of SG and PL indefinites in negation and questions;
- argue that **PBE can be extended to fully account for probability-sensitivity**, while **PEX + PAI cannot.**

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Presuppositional exhaustification

- An approach that derives scalar implicatures as presuppositions (Bassi et al. 2021).
- In contrast to EXH used in ordinary grammatical approaches to scalar implicature, which negates alternatives as part of the assertion, PEX negates alternatives as part of the presupposition.

(9) $[\![\text{EXH}\ \varphi]\!] := [\![\varphi]\!] = 1 \wedge \bigwedge\{[\![\psi]\!] = 0 : \psi \in \text{IE}(\varphi)\}$

(10) $[\![\text{PEX}\ \varphi]\!] := \begin{cases} \text{PRESUPPOSES} & \bigwedge\{[\![\psi]\!] = 0 : \psi \in \text{IE}(\varphi)\} \\ \text{ASSERTS} & [\![\varphi]\!] = 1 \end{cases}$

PEX with (anti-)multiplicity

- Doron (2024, 2025) applies the PEX mechanism to derive (anti-)multiplicity inferences.
- Importantly, this approach can predict the oddness under negation, because PEX allows scalar implicatures as presuppositions to project from under negation.

Positive PL under PEX

(11) Frank has **Roman noses**.

a. PEX [[∃ [λ*y* [PEX [*y* Roman nose-PL]]]] λ*x* [**f** has *x*]]

b.
- 1 if Frank has mutiple Roman noses
- 0 if Frank has zero Roman noses
- # otherwise (Frank has exactly one Roman nose)

c.
- PRESUPPOSES Frank has zero or multiple Roman noses
- ASSERTS Frank has multiple Roman noses

Negative PL under PEX

(12) Frank doesn't have **Roman noses**.

a. PEX [¬ [PEX [[∃ [λ*y* [PEX [*y* Roman nose-PL]]]] λ*x* [**f** has *x*]]]]

b.
- 1 if Frank has zero Roman noses
- 0 if Frank has mutiple Roman noses
- # otherwise (Frank has exactly one Roman nose)

c.
- PRESUPPOSES Frank has zero or multiple Roman noses
- ASSERTS Frank has zero Roman noses

Anti-multiplicity with PAI

- A local accommodation operator A is needed to derive the anti-multiplicity inference:

(13) $[\![\mathrm{A}\,\varphi]\!] := \begin{cases} 1 & [\![\varphi]\!] = 1 \\ 0 & \text{otherwise } ([\![\varphi]\!] = 0 \text{ or } [\![\varphi]\!] = \#) \end{cases}$

Positive SG under PEX

(14) Frank has **a Roman nose**.

a. PEX [A [[∃ [λ*y* [PEX [*y* Roman nose-SG]]]] λ*x* [**f** has *x*]]]

b.
- 1 if Frank has exactly one Roman nose
- 0 if Frank has zero Roman nose
- # otherwise (Frank has multiple Roman noses)

c.
- PRESUPPOSES Frank has zero or exactly one Roman nose
- ASSERTS Frank has exactly one Roman nose

Negative SG under PEX

(15) Frank doesn't have **a Roman nose**.

a. PEX [¬ [PEX [A [[∃ [λ*y* [PEX [*y* Roman nose-SG]]]] λ*x* [**f** has *x*]]]]]

b.
- 1 if Frank has zero Roman nose
- 0 if Frank has exactly one Roman nose
- # otherwise (Frank has multiple Roman noses)

c.
- PRESUPPOSES Frank has zero or exactly one Roman nose
- ASSERTS Frank has zero Roman noses

Summarizing the results

- With PEX, *Frank doesn't have Roman noses* and *Frank doesn't have a Roman nose* are not equivalent.
- While they assert the same thing, they have different presuppositions/implicatures projected from under negation:

(16) Frank doesn't have **Roman noses**.

PRESUPPOSES	Frank has zero or multiple Roman noses
ASSERTS	Frank has zero Roman noses

(17) Frank doesn't have **a Roman nose**.

PRESUPPOSES	Frank has zero or exactly one Roman nose
ASSERTS	Frank has zero Roman noses

Post-Accommodation Informativity

- The next step is to take advantage of the difference in presupposition and derive oddness/infelicity for one but not the other.
- A Stalnakerian principle that constraints presupposition accommodation (Doron & Wehbe 2022):

(18) **Post-Accommodation Informativity (PAI)**
S_p can be uttered felicitously in C only if S is not trivial w.r.t. C after accommodating p.

- *Presupposition accommodation can do some but not all of the work of modifying the context.*

Oddness from PAI

- Assuming that common sense constrains the context set, i.e., worlds incompatible with common sense are not in the context, PAI immediately predicts the infelicity of *Frank doesn't have Roman noses*.

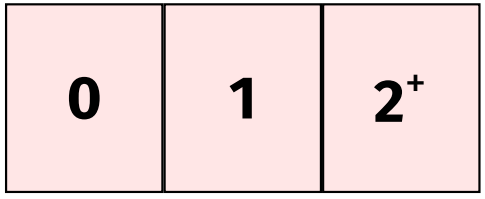
Some abbreviations

- **0** is the set of worlds where Frank has zero Roman noses.
- **1** is the set of worlds where Frank has exactly one Roman nose.
- $\mathbf{2}^{+}$ is the set of worlds where Frank has multiple Roman noses.
- $\mathbf{0}_{\mathbf{0} \cup \mathbf{2}^{+}}$ is the denotation of Frank doesn't have Roman noses.
- $\mathbf{0}_{\mathbf{0} \cup \mathbf{1}}$ is the denotation of Frank doesn't have a Roman nose.

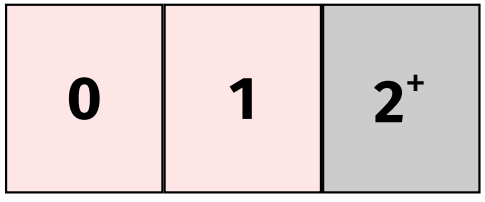
Frank doesn't have Roman noses under PAI

PRESUPPOSES $\mathbf{0} \cup \mathbf{2}^+$

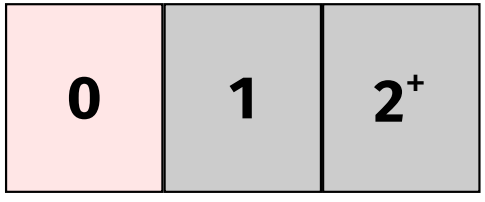
ASSERTS $\mathbf{0}$



Logical space *U*



Common sense context *C*



Accommodating $\mathbf{0} \cup \mathbf{2}^+$

$C \cap (\mathbf{0} \cup \mathbf{2}^+)$

Asserting 0 trivial!

From PAI to modal presupposition

- The PEX + PAI approach to oddness of indefinites under negation derives the modal presupposition, if we understand the presupposition to be the **felicity condition**.
- PAI restated with quantification over worlds in the context:

  (19) S_p is felicitous in C only if $\exists w \in C \cap p. S(w) = 0$
- There must be worlds in the context where the positive strengthened counterpart is true, if p is generated via PEX.
- "Frank could have had multiple Roman noses"

Outline

Partition by exhaustification (PBE)

- There is an alternative to the PEX + PAI theory.
- Partition by exhaustification (Fox 2018, 2020b, Katzir 2024).
- Adopting the formulation of felicity constraints in Katzir (2024),

(20) **F-TO-QUESTION**
A suitably chosen $Q \subseteq \text{ALT}_F(S)$ corresponds to a question.

(21) **Q-A-FELICITY**
Said Q is a good question in C; S is a good answer to Q.

(22) **PARTITION-BY-EXH**
Q is good in C if its elements exhaustified (EXH) partition C.

Applying PBE to negated indefinites

- Negated sentences *not φ* should have *φ* as a focus alternative.
- Then the set to partition the context is

  (23) {EXH *φ*, EXH not *φ*}

- For *Frank doesn't have Roman noses*,

  (24) $\left\{ \begin{array}{l} \text{EXH Frank has Roman noses} \\ \text{EXH Frank doesn't have Roman noses} \end{array} \right\}$

- Assuming that EXH *φ* in the partition has whatever implicatures present as if directly asserted, (24) is in effect (25):

  (25) $\left\{ \begin{array}{l} \text{Frank has multiple Roman noses} \\ \text{Frank has zero Roman noses} \end{array} \right\}$

Oddness from PBE

- By definition, **cells in a partition must be non-empty**.

(26) { Frank has multiple Roman noses
Frank has zero Roman noses }

- However, for C following common sense, $C \cap [\![\text{Frank has multiple Roman noses}]\!] = \emptyset$, because people do not have more than one nose.
- Thus, the set produced via PARTITION-BY-EXH for *Frank doesn't have Roman noses* **fail to partition common sense contexts**.
- Thus, PBE predicts infelicity for *Frank doesn't have Roman noses*.

Modal presupposition and PBE

- The non-emptiness of cells under PBE directly translates to the modal presupposition.
- The positive counterpart, strengthened, becomes a cell.
- The context must have worlds in that cell.

  (27) For not φ to be felicitous,
  $\exists w \in C. [\![\text{EXH}\ \varphi]\!] = 1$

- "Frank could have had multiple Roman noses."

The oddness of indefinites in questions

- The oddness of indefinites persists in polar questions:

  (28) a.#Does Frank have Roman noses?
  b.#Does Frank have a blue eye?

- Both PEX + PAI and PBE can extend to this case.
- **PEX + PAI** can claim that both answers to the question should be felicitous; however
  - *Frank has Roman noses* is post-accommodation contradictory.
  - *Frank doesn't have Roman noses* is post-accommodation trivial.
- For **PBE**, the questions are themselves odd because the exhaustified alternatives fail to partition common sense contexts.

Outline

Competing analyses of the modal presupposition

- Both PEX + PAI and PBE can account for the oddness/modal presupposition of indefinites in negation and in questions.
- Additionally, both of them have independent motivations outside of the phenomenon at hand (Bassi et al. 2021, Del Pinal et al. 2024, Fox 2018, 2020a, Katzir 2024).
- We believe a phenomenon related to modal presupposition can be the testing ground for the two theories.

Outline

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Probability-sensitivity of negated indefinites

- Sudo (2023) observes that even when there is no categorical oddness, there is still a preference of SG or PL indefinites over the other if there is difference in contextual probability.

  (29) a. The grad student won't submit abstracts to CLS.
  b. The grad student won't submit an abstract to CLS.

- (29a) should be preferred when it is *more likely* for the grad student to submit *multiple* abstracts to CLS.
- (29b) should be preferred when it is *more likely* for the grad student to submit *exactly one* abstract to CLS.

Experimental evidence

- This probability-sensitive preference is also experimentally established in Enguehard (2024).
- Enguehard (2024) exposes participants to conditions with differing ratios between occurrences of objects appearing in multiples or in singles.
- Conditions are ordered by increasing the frequency of stimuli containing multiple symbols of the same kind ranging from 0%, 10%, 50%, 90%, to 100% in order.
- The participants are then asked to describe a situation of non-existence.
- The type of response is recorded (negated SG indefinite, negated PL indefinite, and other).

Experimental evidence

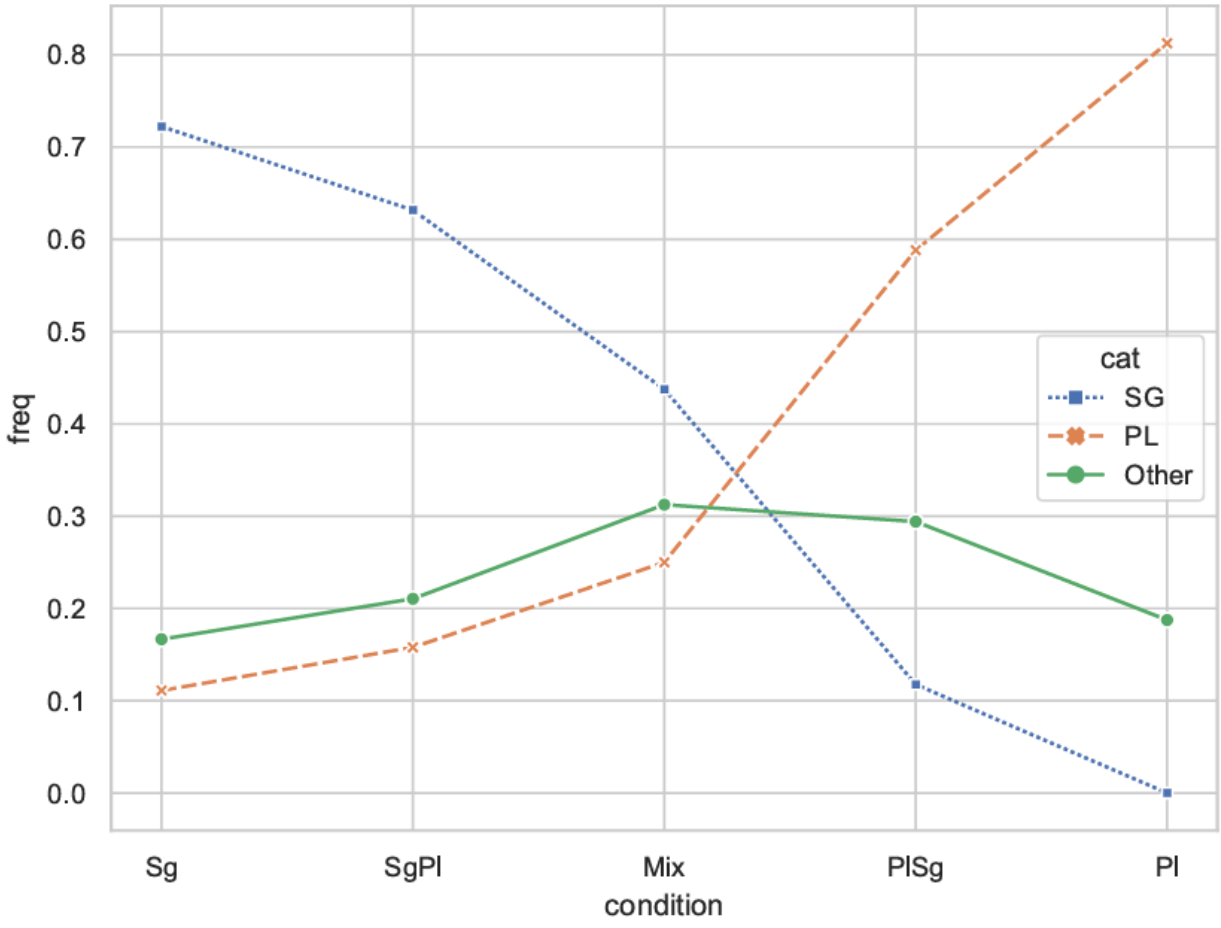


Figure: Proportion of participants producing negated SG or PL indefinites.

Probability-sensitivity in questions

- While there is no experimental data, we think the probability-sensitive preference between the SG and PL indefinites persists in polar questions.

  (30) a. Will the grad student submit abstracts to CLS?
  b. Will the grad student submit an abstract to CLS?

- This will in fact be the critical case deciding between the two theories.

Two categorical approaches

- Both PEX + PAI and PBE are categorical theories.
- When both 'exactly one' and 'multiple' are contextual possibilities, neither theory predicts a distinction between the SG and PL versions of the sentence.
- Both versions are simply felicitous, under both theories.

☛ Both theories need to be made sensitive to probability and give gradient felicity values to derive the preference of one over the other.

Outline

The PEX + PAI response

- Take a probabilistic view of informativity: **informativity = surprisal, negatively correlated with contextual probability**.
- Take felicity also to be gradient, allowing (31) to be stated:

  (31) **Probabilistic Post-Accommodation Informativity (PPAI)**
  $\text{fel}(S_{p'}, C) > \text{fel}(S_p, C)$ if $0 < P(S \mid C \cap p') < P(S \mid C \cap p)$.
- Of two sentences with the same assertion S, PPAI says that the sentence with the lower non-zero post-accommodation contextual probability is more felicitous, because it is **more informative**.
- The original categorical PAI can be subsumed if we require that $\text{fel}(S_p, C) = 0$ if $P(S \mid C \cap p) = 1$.

Probability-sensitivity from PPAI

- The grad student won't submit an abstract to CLS.
  - PRS G.S. will submit zero (**0**) or exactly one (**1**) abstract to CLS
  - ASR G.S. will submit zero (**0**) abstracts to CLS
- ☛ $\mathbf{0}_{\mathbf{0}\cup\mathbf{1}}$
- The grad student won't submit abstracts to CLS.
  - PRS G.S. will submit zero (**0**) or multiple ($\mathbf{2}^{+}$) abstracts to CLS
  - ASR G.S. will submit zero (**0**) abstracts to CLS
- ☛ $\mathbf{0}_{\mathbf{0}\cup\mathbf{2}^{+}}$

Probability-sensitivity from PPAI

- Post-accommodation contextual probability negatively correlates with contextual probability of the strengthened positive counterpart.
- Then by PPAI, felicity positively correlates with contextual probability of the strengthened positive counterpart.

$$\text{fel}(\mathbf{0}_{\mathbf{0}\cup\mathbf{1}}, C)\uparrow \Rightarrow P(\mathbf{0} \mid C \cap (\mathbf{0}\cup\mathbf{1}))\downarrow = \frac{P(C\cap\mathbf{0})}{P(C\cap\mathbf{0}) + P(C\cap\mathbf{1})\uparrow}$$

$$\text{fel}(\mathbf{0}_{\mathbf{0}\cup\mathbf{2}^+}, C)\uparrow \Rightarrow P(\mathbf{0} \mid C \cap (\mathbf{0}\cup\mathbf{2}^+))\downarrow = \frac{P(C\cap\mathbf{0})}{P(C\cap\mathbf{0}) + P(C\cap\mathbf{2}^+)\uparrow}$$

Probability-sensitivity from PPAI

- This has derived the probability-sensitivity.
- *The grad student won't submit abstracts to CLS* will be preferred if it is contextually more likely that they submit multiple abstracts.

PPAI fails with probability-sensitivity in questions...

- (32) a. Will the grad student submit abstracts to CLS?
  b. Will the grad student submit an abstract to CLS?
- ... because the post-accommodation probabilities of the two answers **sum up to 1** for both the SG and PL indefinites.

$$P(\mathbf{0} \mid C \cap (\mathbf{0} \cup \mathbf{1})) + P(\mathbf{1} \mid C \cap (\mathbf{0} \cup \mathbf{1}))$$
$$= P(\mathbf{0} \cup \mathbf{1} \mid C \cap (\mathbf{0} \cup \mathbf{1})) = 1$$
$$P(\mathbf{0} \mid C \cap (\mathbf{0} \cup \mathbf{2}^+)) + P(\mathbf{2}^+ \mid C \cap (\mathbf{0} \cup \mathbf{2}^+))$$
$$= P(\mathbf{0} \cup \mathbf{2}^+ \mid C \cap (\mathbf{0} \cup \mathbf{2}^+)) = 1$$

PPAI fails with probability-sensitivity in questions

- PPAI also cannot apply to the question as a whole.
- Because by definition, a question does not make an assertion.
- There is no way to evaluate the post-accommodation informativity of a question.

Outline

The response from PBE

- Start with the case where PPAI fails, i.e., probability-sensitive preference in questions.
- PBE can make PARTITION-BY-EXH a probabilistic constraint.
- Some mismatch between the partition generated by the sentence and the context should be allowed, but the mismatch should be minimized.
- Intuitively, when we ask *Will the grad student submit abstracts/an abstract to CLS?*, we do not intend to really accommodate the presupposition that the grad student cannot submit exactly one/multiple abstract(s) to CLS.

Minimize Question Accommodation (MQA)

- Thus: an **intended context** C and an **intended partition** Q of C:

  (33) a. the given context C unchanged,
  b. a partition of C into two cells, $Q = \{\mathbf{0}, \mathbf{1}^+\} = \{\mathbf{0}, \mathbf{1} \cup \mathbf{2}^+\}$.

- The results of PARTITION-BY-EXH from competing sentences can be evaluated against the intended C and Q.

  (34) **Minimize Question Accommodation (MQA)**
  Given an intended partition Q for an intended C, and two viable candidate partitions Q_1 and Q_2,
  $\text{fel}(Q_1, Q, C) > \text{fel}(Q_2, Q, C)$ if $P(\bigcup Q_1 \mid C) > P(\bigcup Q_2 \mid C)$.

- *MQA prefers the candidate partition that probabilistically covers more of the intended context.*

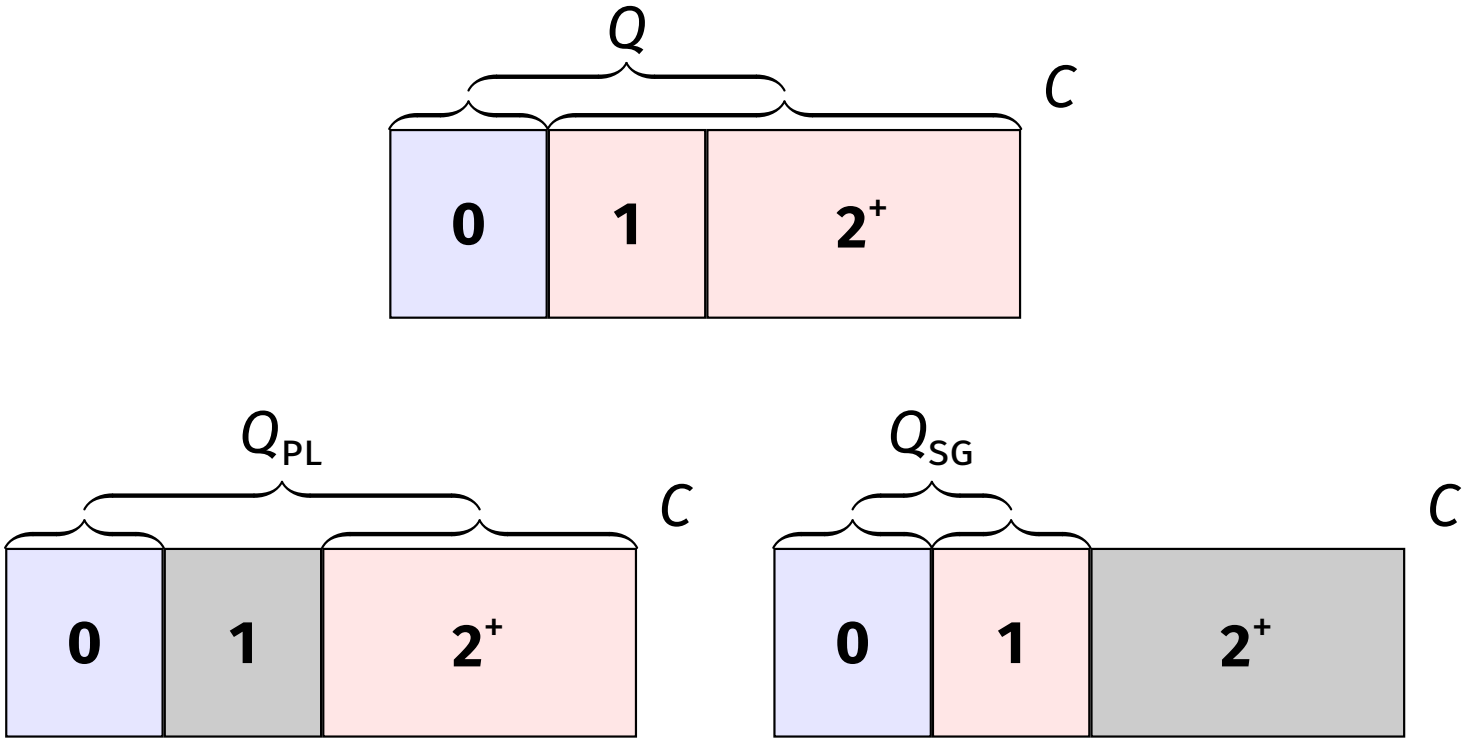
Probability-sensitivity in questions from MQA

- The potential partitions:

(35) Will the grad student submit an abstract to CLS?
Q_{SG} = {**0**, **1**}

(36) Will the grad student submit abstracts to CLS?
Q_{PL} = {**0**, **2**$^{+}$}

MQA generating probability-sensitive preference



$$P(\mathbf{2}^{+} \mid C) > P(\mathbf{1} \mid C) \Longrightarrow P(\bigcup Q_{PL} \mid C) > P(\bigcup Q_{SG} \mid C)$$

Negated indefinites

- PBE with MQA thus derives the probability-sensitivity of questions with indefinites.
- Once questions are dealt with, negated indefinites are also explained, as soon as we assume the same intended C and Q.
- If it is contextually more likely that the grad student will submit multiple abstracts, then the negated PL indefinite is preferred, because the potential partition produced via PARTITION-BY-EXH is preferred under MQA.

Restricting the competition set

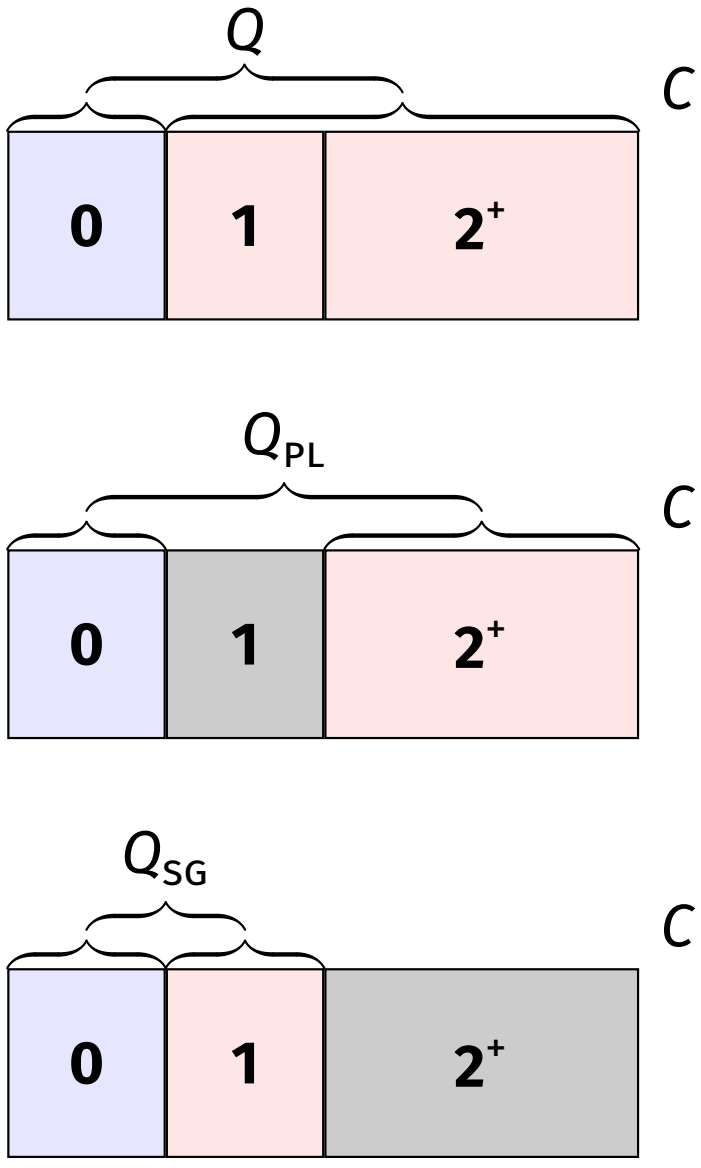
- Here is a catch.
- We do not want to prefer a random partition simply because it probabilistically covers more of C.
- For example, *Is it raining?* should not be preferred just because it totally covers the context but *Will the grad student submit abstracts to CLS?* doesn't, because these are intuitively, unrelated questions that do not compete.
- The restriction on competition is encoded in the word *viable*:

(37) **Minimize Question Accommodation (MQA)**
Given an intended partition Q for an intended C, and two **viable** candidate partitions Q_1 and Q_2,
$\text{fel}(Q_1, Q, C) > \text{fel}(Q_2, Q, C)$ if $P(\bigcup Q_1 \mid C) > P(\bigcup Q_2 \mid C)$.

Restricting the competition set

- (38) **Viability**
  Q' is *viable* for Q if
  a. $\forall q' \in Q'. \exists! q \in Q. q' \subseteq q$, and
  b. $\forall q \in Q. \exists! q' \in Q'. q' \subseteq q$.
- The Viability condition restricts the competition set to questions with the same number of cells and whose cells identify the cells of the intended question.
- This rules out *Is it raining?* as a competitor to *Will the grad student submit abstracts to CLS?*, but allows *Will the grad student submit an abstract to CLS?*, given the intended C and Q.
- This is reminiscent of the move to PPAI, where the competition set is restricted to sentences with the same assertion.

Both Q_{SG} and Q_{PL} are viable for Q



Further restricting the competition set

- There is yet another kind of competitor to rule out.

(39) a. Will the grad student submit **an abstract or abstracts** to CLS?
b. Will the grad student submit **at least one abstract** to CLS?

- Both in (39) fully cover C and exactly match the intended Q.
- By MQA, they should always be preferred over either

(40) a. Will the grad student submit abstracts to CLS?
b. Will the grad student submit an abstract to CLS?

- ...contrary to intuition judgment.

Further restricting the competition set

- Intuitively, those in (39) are too complex; one is unwilling to say such complicated things just to minimize the unnecessary accommodation.
- The MQA can be augmented by requiring that candidates compared are of equal structural complexity, in the sense of Katzir (2007).
- This competition logic is also reminiscent of Haslinger (2023).
- Again, PEX and PPAI require this kind of restriction as well.

Outline

Conclusion

- We have seen two approaches to the oddness arising from SG and PL indefinites when negated or in polar questions.
  - PEX + PAI
  - PBE
- They can both be extended to the related probability-sensitivity preference under negation, via PPAI and MQA, respectively.
- The probability-sensitivity preference in polar questions, however, is a challenge to PEX + PPAI but is accounted for by PBE + MQA.

☛ PBE proves to be the more extensible theory.

☛ Extensibility to gradient probabilistic data can help decide between categorical theories.

Thank you!

Extensions

- The oddness/modal presupposition and probability-sensitive preference is not limited to SG and PL indefinites.
- Other scalar items, e.g., disjunction

(41) Context: Mary and Sue are Siamese twins. (Spector 2007)

a. Frank didn't meet Mary and Sue.

b.#Frank didn't meet Mary or Sue.

⇝ Frank could have met just one of Mary or Sue.

Extensions

- Homogeneity of definite plurals

(42) Context: I prepared 25 burgers for guests at a party to eat. John, a guest, doesn't like burgers.

a. John didn't eat any of the 25 burgers.

b.#John didn't eat the 25 burgers.

$\rightsquigarrow$ John could have eaten all 25 burgers.

Extensions

- Free choice

(43) Context: John's mother is strict. She at most allows John to only one of TV watching or video gaming on a given day. Today, she is even stricter.

a. Today, John is neither allowed to watch TV nor allowed to play video games.

b.#Today, John isn't allowed to watch TV or play video games.

$\rightsquigarrow$ John could have been allowed to watch TV or play video games.

Extensions

- Expressions denoting scalar endpoints

(44) a. #All of the Italians come from a warm country.
⇝ It could have been the case only some of the Italians come from a warm country.

b. #All of John's children have a wonderful dad.
⇝ It could have been the case only some of John's children come from a warm country.

- These cases are also challenges for the PEX + (P)PAI approach.

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