Deriving presupposition projection in coordinations of polar questions: A reply to Enguehard 2021

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Abstract

This paper is a response to Enguehard 2021, who observes that presuppositions project in the same way from coordinations of declaratives and coordinations of polar questions, but existing mechanisms of projection from declaratives (e.g. Schlenker, 2008, 2009) fail to scale to questions. His solution involves specifying a trivalent inquisitive semantics for (coordinations of) questions that bakes the various asymmetries of presupposition projection into the lexical entry of conjunction/disjunction. However, we argue that such a move faces both theoretical and empirical issues. Instead, we show that the data can be handled without moving to such a trivalent inquisitive denotation, by adapting the novel pragmatic theory of *Limited Symmetry* (Kalomoiros Forthcoming) to an inquisitive framework in a way that leaves the underlying semantics for conjunction symmetric and bivalent, while deriving the projection data.

1 Introduction

This paper is a response to Enguehard 2021, who observes that presuppositions project in the same way from coordinations of declaratives and coordinations of polar questions, but existing mechanisms of projection from declaratives (e.g. Schlenker, 2008, 2009) fail to scale to questions. His solution involves specifying a trivalent inquisitive semantics for (coordinations of) questions that bakes the various asymmetries of presupposition projection into the lexical entry of conjunction/disjunction. However, we argue that such a move faces both theoretical and empirical issues. Instead, we show that the data can be handled without moving to such a trivalent inquisitive denotation, by adapting the novel pragmatic theory of *Limited Symmetry* (Kalomoiros Forthcoming) to an inquisitive framework in a way that leaves the underlying semantics for conjunction symmetric and bivalent, while deriving the projection data.

The basic idea underlying our approach is Stalnakerian in origin: just like the presupposition of the second conjunct in a conjunction of declaratives ($p \wedge q$) is evaluated against a context that does not include worlds where p is False (Stalnaker 1974), so the presupposition of the second conjunct in a conjunction of polar questions, ($?p \wedge ?q$), is only evaluated against subsets of the context that do not correspond to **negative polarity** answers to ($?p \wedge ?q$). Since all sets of worlds where $\neg p$ is true correspond to a negative response to ($?p \wedge ?q$), $?q$ will be evaluated against sets of worlds where p holds.

We formalize this idea within an inquisitive extension of the theory of *Limited Symmetry* (Kalomoiros Forthcoming). This is a pragmatic, parsing-oriented approach to projection that aims to keep the semantics of the connectives classical (in the spirit of Stalnaker 1974 and Schlenker 2009). It was originally designed as a theory that can derive **asymmetric** conjunction but **symmetric** disjunction from a single mechanism (unlike e.g. Schlenker 2009 who has to postulate distinct mechanisms for symmetry vs asymmetry). The core of our response consists in showing that *Limited Symmetry* lends itself very naturally to an inquisitive extension that derives Enguehard's data.

The rest of the paper is organized as follows: Section 2 reviews the main issues and data, Enguehard 2021's approach to them, and examines motivations for the alternative pursued in this paper. Section 3 introduces the theory of *Limited Symmetry*, and shows how it accounts for the projection behavior of declaratives. Section 4 lifts *Limited Symmetry* to an inquisitive framework and proceeds to apply it to Enguehard's data. The main focus is on conjunction (since this is what Enguehard 2021 mostly focuses on as well), but in section 5 we also spell out the system's predictions for disjunctions (which are systematically predicted to be symmetric, in contrast to conjunctions, and in contrast to Enguehard 2021). Section 6 concludes.

2 Background

2.1 The problem

Enguehard 2021 (henceforth E) makes the novel observation that coordinations of polar questions behave very similarly to their declarative counterparts in terms of presupposition projection,[1] with the same asymmetry holding in both cases: when the question/declarative in the first conjunct entails the presupposition of the question/declarative in the second conjunct, that presupposition is filtered. However when the question/declarative in the second conjunct entails the presupposition of the question/declarative in the first conjunct, infelicity ensues (in contexts that do not support the relevant presupposition), which is typically attributed to projection:[2]

(1) Declaratives
   a. ***Context:*** We have no idea whether or not Emily is married.
   b. Emily is married and her spouse is a doctor.
   c. #Emily's spouse is a doctor and she is married.

(2) Questions
   a. ***Context:*** We have no idea whether or not Emily is married.
   b. Is Emily married and is her spouse a doctor?
   c. #Is Emily's spouse a doctor and is she married?

This paradigm crucially shows that the projection problem generalizes across speech acts,

[1] But see Van Rooij 2005 for an interesting precursor that examines the general problem of projection from modal subordination environments, and who considers (among other things) a version of E's data.

[2] E's original paper makes use of the following example:

(i) Is Syladvia a monarchy and is the Syldavian monarch a progressive?

However, when considering the negation of 'Syldavia is monarchy' in the context of negated polar questions, and disjoined questions, E takes the opposite of 'monarchy' to be 'republic', leading to examples like:

(ii) #Is Syldavia a republic and is the Syldavian monarch a progressive?

Native speakers that I consulted found it hard to keep in mind 'monarchy' and 'republic' as polar opposites, as they did not consider these two systems to exhaust the types of government. The examples in the current paper are still based on the existential presupposition of definites, but instead exploit the 'married' vs 'unmarried' contrast which was judged a lot more straightforward by consultants.

setting up a simple (yet hard) challenge for any account of projection that purports to be explanatory: does the explanation for the declarative case generalize to the question case in a straightforward fashion?

The problem is compounded by the fact that in classic approaches to the semantics of questions, polar questions receive a symmetric denotation in terms of their resolution conditions. We illustrate this via the inquisitive semantics approach to polar questions (Ciardelli et al., 2013, 2018):

(3) a. Is Mary married?
 b. $\{s \mid s \vdash \ulcorner\text{Mary is married}\urcorner \textit{ or } s \vdash \ulcorner\text{Mary is unmarried}\urcorner\}$

The idea behind the inquisitive denotation in (3b) is that the resolution conditions of a polar question should be states (where a state is a set of possible worlds) which provide a **complete** answer to the question. Thus, the resolution conditions for the question in (3a) will consist of states which support the sentence 'Mary is married' and states which support that 'Mary is unmarried', as in both kinds of state the question is fully resolved (in inquisitive semantics, a state s supports ($\vdash$) an inquisitive sentence p iff $|p|$ is true in all worlds in s, where $|p|$ is the classical proposition associated with p). While the states perspective is based on the inquisitive semantics approach to question meanings, both Karttunen/Hamblin semantics (Hamblin, 1976; Karttunen, 1977) and partition semantics (Groenendijk & Stokhof, 1984) essentially pursue a similar idea (see E for details). For the purposes of this reply, we will be focusing on the inquisitive approach.

Given the above, positive and negative polar questions are predicted to have the same resolution conditions; and the same holds for the 'or not' counterparts of positive polar questions:

(4) a. Is Emily married?
 b. Is Emily unmarried?
 c. Is Emily married or not?
 d. $\{s \mid s \vdash \ulcorner\text{Emily is married}\urcorner \textit{ or } s \vdash \ulcorner\text{Emily is unmarried}\urcorner\}$

As E points out, if (4d) is the denotation of all the polar questions in (4a)-(4c), then these should be interchangeable in the paradigm in (2). However, the intuitive judgment is that this is not the case; examples (5c)-(5d) are infelicitous:

(5) a. ***Context:*** We have no idea whether Emily is married.
 b. Is Emily married and is her spouse a doctor?
 c. #Is Emily unmarried and is her spouse a doctor?
 d. #Is Emily married or not, and is her spouse a doctor?

The outcome of all this, according to E, is that any account of the asymmetry of the projection data in (2) cannot be based on the resolution conditions semantics for polar questions, as this semantics is not fine-grained enough to differentiate between positive and negative versions of a polar question (as the data in (5) seem to require). Moreover, E shows that the resolution conditions semantics is also inadequate in an even more fundamental respect: combined with current explanatory accounts of presupposition projection for declaratives (Schlenker 2008, Schlenker 2009, George 2008b) it leads to wrong results for projection from coordinations of polar questions. To properly see this, a brief foray into Schlenker 2009 is required.

2.2 Schlenker 2009

The filtering asymmetry in declaratives, (1), has generated a lot of debate: Stalnaker's original suggestion was that the asymmetry is pragmatic, rooted in the inherently left-to-right nature of incremental interpretation (Stalnaker, 1974): as a conjunction is incrementally interpreted, we get access to the initial conjunct first; thus, when we get access to the second conjunct, this gets interpreted against a set of worlds that entails the first conjunct. While explanatorily powerful, this way of thinking did not generalize straightforwardly to other connectives; in turn, this led to the dynamic approach of Heim 1983, which put the relevant asymmetries into the lexical entry of the connectives: for instance conjunction is asymmetric because it denotes a function that updates a context C **first with the initial conjunct**. Despite the gains in empirical coverage, the dynamic approach was criticized for semanticizing the asymmetries: if we can write a lexical entry for conjunction that updates with the initial conjunct first, then we can write an entry that updates with the second conjunct first; nothing in the formalism forces one option over the other (Soames 1989 a.o.).

More recently, there have been attempts to retain the explanatoriness of Stalnaker's intuition within a theory that keeps the empirical coverage of dynamic semantics (Schlenker, 2008, 2009; Rothschild, 2011). Schlenker 2009's *Local Contexts* theory represents one influential attempt along these lines: its aim is to formalize the idea that a presupposition must be entailed by its *local context* (Karttunen 1974 a.o.) in a way that is predictive across connectives. Since this is the approach that E takes to represent his baseline for an explanatory theory of projection, it's worth presenting the basic idea.[3]

The original intuition behind local contexts in Karttunen and Heim's work was that as various parts of a sentence S are integrated in a global context C, the context changes depending on the truth-conditional import of S. These new sub-contexts that come about as each part of S is integrated into the global context, are the local contexts against which presuppositions of the parts of S need to be evaluated. For Schlenker 2009, a *Local Context* is a more static, but still pragmatic notion, defined as follows:[4]

(6) **(Asymmetric) Local Context:** The asymmetric local context of a sentence E in a syntactic environment $a \_ b$ and global context C is the strongest proposition r such that for all sentences D and good finals b', $C \models a(r \text{ } and \text{ } D)b' \leftrightarrow a(D)b'$.

Thus, the local context of a sentence E in a syntactic environment $a \_ b$ is the strongest proposition r that can be conjoined to an expression that occupies the same position as E, while retaining the equivalence with the version where r has not been conjoined. More intuitively, r represents the set of worlds where the truth value of E matters. In the case of a conjunction (p *and* q), the Local Context of q is p: when evaluating q, one can restrict attention to all the C-worlds where p is true, since in all worlds in the context where p is False, the truth value of q doesn't matter; the conjunction is already false. However, the Local Context for p is all the worlds in C, since in all of them the truth value of p matters

[3] E's paper is stated in terms of Schlenker's *Transparency Theory* (Schlenker, 2008). *Transparency Theory* is equivalent to *Local Contexts* (see the appendix in Schlenker 2009).

[4] The definition below is restricted to the propositional case and is borrowed from Mandelkern & Romoli 2017. See Schlenker's original paper for the full definitions.

for the overall truth value of the conjunction. Thus, Schlenker 2009 derives the asymmetry of conjunction, while keeping the semantics fully symmetric. His theory represents a major advance in providing an account of projection that is explanatory and fully general at the same time.[5] Given the theory's success, it's natural to wonder if it can be extended to the questions data. E argues that it cannot.

2.3 The tripartition requirement

We follow the inquisitive semantics notation and represent a polar question as $?p$. A conjunction of polar questions will be notated as $(?p \wedge ?q)$. The reason that the approach of Schlenker 2009 does not carry over to the question data is that $(?p \wedge ?q)$, denotes a set that contains four different kinds of states (we will call this set the *quadripartition* following E):

(7) $\{s \mid s \vdash p \textit{ or } s \vdash \neg p\} \cap \{s \mid s \vdash q \textit{ or } s \vdash \neg q\}$.

This is equivalent to:

(8) **Quadripartition denotation:** $\{s \mid (s \vdash p \textit{ and } s \vdash q) \textit{ or } (s \vdash p \textit{ and } s \vdash \neg q) \textit{ or } (s \vdash \neg p \textit{ and } s \vdash q) \textit{ or } (s \vdash \neg p \textit{ and } s \vdash \neg q)\}$

A conjunction of polar questions then denotes a partition of the context into states where both p and q holds, states where p holds but q doesn't hold, states where p doesn't hold but q holds, and finally states where neither p nor q hold. Under an approach to question meaning as resolution conditions, this makes sense. In each kind of state, we are able to give a complete answer to the question arising from conjoining the questions $?p$ and $?q$.

Taking two questions to be equivalent just in case they denote the same set of states (contextually), then the local context of $?q$ in $(?p \wedge ?q)$ is the strongest r such that for all D and all b', it holds contextually that $(?p \wedge (r \wedge D)b' \equiv (?p \wedge (D)b'$. Since the only possible b' here is the closing parenthesis, this is equivalent to requiring that $(?p \wedge (r \wedge D)) \equiv (?p \wedge D)$.

Note that now r cannot be p. To see this, consider the case where $D = ?q$. In inquisitive semantics, p denotes a set of states that support p: $\{s \mid s \vdash p\}$. Hence conjoining p to $?q$ gives us:

(9) $\{s \mid s \vdash p\} \cap \{s \mid s \vdash q \textit{ or } s \vdash \neg q\} = \{s \mid (s \vdash p \textit{ and } s \vdash q) \textit{ or } (s \vdash p \textit{ and } s \vdash \neg q)\}$.

Therefore, in the case of $?p \wedge (p \wedge ?q)$ we get:

(10) $\{s \mid s \vdash p \textit{ or } s \vdash \neg p\} \cap \{s \mid (s \vdash p \textit{ and } s \vdash q) \textit{ or } (s \vdash p \textit{ and } s \vdash \neg q)\} =$
$\{s \mid (s \vdash p \textit{ and } s \vdash q) \textit{ or } (s \vdash p \textit{ and } s \vdash \neg q)\}$

This is not necessarily equivalent to the quadriparition in (8). In fact, E argues that the only way for p to be the local context for the second conjunct of a conjunctive question is

[5] That is not to say that there aren't issues. In particular the case of connectives that behave symmetrically (e.g. disjunction) forces Schlenker to introduce a second kind of local context that works symmetrically (and makes both conjunction and disjunction symmetric); in this respect some of the questions that arise in Heim's theory reappear, in the form of what conditions the choice of one kind of local context over the other. It is exactly this kind of problem that *Limited Symmetry* was originally designed to solve. See section 3 for some more discussion of this, as well as Kalomoiros & Schwarz (2021, Under review).

for the question to have the form $?(p \wedge ?q)$. In this case, a conjunctive question denotes a ***tripartition***:

(11) **Tripartition denotation:** $\{s \mid (s \vdash p \textit{ and } s \vdash q) \textit{ or } (s \vdash p \textit{ and } s \vdash \neg q) \textit{ or } (s \vdash \neg p)\}$

Going through the *Local Contexts* reasoning reveals that for all D, $?(p \wedge (p \wedge D))$ is equivalent to $?(p \wedge D)$; hence p will be the local context for $?q$.[6] If $?q$ carries any presuppositions, they will need to be entailed by the set of worlds p denotes in C, which gives us the correct filtering conditions.

However, as E points out, $?(p \wedge ?q)$ does not represent the syntax that questions like (2) arguably have: they are conjunctions of questions, not questions of the conjunction of a declarative with a question (see E's paper for an elaboration of this criticism). Thus, E aims to develop an account that essentially makes a conjunctive polar question denote the tripartition in (11), while retaining the syntactic intuition that we are dealing with a conjunction of questions.

2.4 Enguehard 2021's account

E states his solution in a framework where questions denote trivalent inquisitive predicates:

(12) $$?p = \lambda s. \begin{cases} 1, \text{if } s \vdash p \\ 0, \text{if } s \vdash \neg p \\ \#, \text{ otherwise} \end{cases}$$

This predicate of states maps a state s to 1 if s supports p, to 0 if s supports the negation of p, and to # otherwise. The # case is meant to capture the cases where either: **i)** s contains a mix of worlds, where in some p is 1 while in others 0; **ii)** the presuppositions of p fail.

E formalizes this within a fully trivalent system in which presupposition failure for both declaratives and questions is modeled as #. However, as he points out, the choice matters only in the case of questions. Simple declaratives could receive an analysis within Schlenkerian local contexts. Furthermore, note that the denotation in (12) assigns different denotations to positive vs negative polar questions, as the negative polar questions map states that support p to 0, and states that support $\neg p$ to 1. This breaks the symmetry between positive and negative polar questions (as well as 'or not' questions) and allows E to account for the asymmetries in (5).

Given this, here's his definition for a coordination of polar questions:

(13) $$?p \wedge ?q = \lambda s. \begin{cases} 1, \text{if } s \vdash p \text{ and } s \vdash q \\ 0, \text{if } s \vdash \neg p, \text{ or } s \vdash p \text{ and} s \vdash \neg q \\ \#, \text{ otherwise} \end{cases}$$

The important thing to note here is that collecting the states that are being mapped to 1,0 by this trivalent predicate creates the tripartition in (11). This makes conjunction of polar questions follow a Middle Kleene logic which derives the desired asymmetry of projection. When does $(?p \wedge ?q)$ map a state s to a classical truth value (and hence doesn't suffer from

[6]The full proof also requires an argument to the effect that nothing stronger than p can be the Local Context. See E's original paper for more details.

presupposition failure)? Either p or $\neg p$ must be supported by s (so the presuppositions of p must be satisfied in s); and if s supports p, then s must also support either q or $\neg q$, so in both cases q must not receive the # value (which is equivalent to saying that all the states that support p must not cause presupposition failure for q, so p entails the presuppositions of q). These are the desired filtering conditions.

Note also that E motivates this kind of denotation on the basis of the possible answers to a question like (2), repeated here as (14a):

(14) a. Is Emily married and is her spouse a doctor?
b. Emily is not married.
c. Emily is married and her spouse is not a doctor.
d. Emily is married and her spouse is a doctor.

The point is that considering the case where both Emily is unmarried and Emily's spouse is not a doctor, is not needed; knowing that the proposition underlying the first conjunct fails is enough to give a complete negative answer. This is captured by the asymmetric denotation in (13), as $\neg p$ *and* $\neg q$ simply does not appear as a case where the question returns 0; knowing that $\neg p$ is enough.

Summarizing, the main claim is that putting classical accounts of polar questions together with a pragmatic theory of presupposition projection like Schlenker 2009 does not lead to a satisfactory account of the projection data in polar questions.[7] E's solution is to treat polar questions as trivalent inquisitive predicates that follow a Middle Kleene logic, thus accounting for the filtering patterns; the same trivalence makes $?p$ (positive polar), $?(\neg p)$ (negative polar), $?p \vee ?(\neg p)$ ('or not') questions denote different objects, hence accounting for their non-substitutability (see E for the details).

2.5 Why look for an alternative?

E claims that the core intuition behind his analysis is that a question Q should be associated with positive and negative answers (states mapped to either 1 or 0 respectively in his analysis), and that whether a state counts as positive or negative depends on whether the proposition related to Q is True or False in that state. While we agree with this core intuition, E's approach captures the data in a way that makes the conjunction of polar questions asymmetric in the semantics; one can then repeat the same question posed in the original asymmetry debate reviewed above: are the asymmetries of 'and' with respect to projection something to bake into the lexical entry, or are they to be derived from more general pragmatic mechanisms (which leave the basic conjunction semantics commutative)?

In addition, while E claims that a *Local Contexts*-style pragmatic approach will not work for (bivalent denotations of) questions, he sketches the possibility that *Local Contexts* could apply to both declaratives and questions, with the condition that while declaratives would receive a classical bivalent semantics, questions would crucially continue to receive a Middle Kleene trivalent semantics. However, this would be a case where *Local Contexts* **derives** the filtering conditions of declaratives, but **restates** the filtering conditions of questions, since the underlying trivalence already encodes the filtering conditions of questions (i.e.,

[7] E extends this claim to trivalent accounts of presupposition projection like George 2008a. The point is that trivalence ends up operating on the question level in E's theory, and not just at the declarative level.

Local Contexts would be explanatory only for declaratives). Such a move would substantially weaken the parallelism between projection from declaratives and projection from questions at the theoretical level. If we think that it is desirable for the declarative data and the question data to receive parallel **explanations**, and if we also think that there is merit (explanatory or otherwise) to the pragmatic, Stalnaker-style approach to projection that *Local Contexts* aims to formalize, then it becomes interesting to inquire whether we can have a successful pragmatic theory of projection that keeps the semantics bivalent across the board, and scales across speech acts.

Last but not least, I want to set up an empirical challenge for the view that makes conjunctions of questions denote the tripartition directly. E himself notes that there are cases where a conjunction of questions seems to denote the quadripartititon, and entertains the possibility that the quadripartitive denotation coexists with the tripartitive one (see his paper for details), with context determining which one is called for in a particular case. However, he maintains that when there is a presupposition trigger, it **forces** the tripartition, as in (14a) (otherwise filtering will not come out right). But consider a minimal variation of (14a), which shows filtering, while simultaneously calling for a quadripartition in terms of its complete answers:

(15) a. ***Context:*** I'm visiting Emily's house, and I see a full pack of Marlboro cigarettes in the dustbin in her office. I have no idea if Emily has ever smoked, so I ask her spouse:

b. Did Emily use to smoke Marlboros and has she stopped smoking?

c. (i) # Emily did not use to smoke Marlboros
(ii) ✓Emily has never smoked.
(iii) ✓Emily didn't use to smoke Marlboros (although she was a smoker), and she has stopped smoking.
(iv) ✓Emily didn't use to smoke Marlboros (although she was a smoker), and she hasn't stopped smoking.

The example in (15b) has the same form as (14a), the only difference being that in (14a), the (proposition underlying) the first conjunct is equivalent to the presupposition of the second conjunct (i.e. that Emily is married), but in (15b) the first conjunct asymmetrically entails the presupposition of the second conjunct (i.e., that Emily used to smoke). The effect is that just negating the first conjunct does not constitute a complete answer to the question, (15c)-(i); instead a complete answer where the first conjunct is negated somehow needs to address the issue raised by the second conjunct as well: either by denying the presupposition of the second conjunct, (15c)-(ii), or by saying that Emily used to smoke and currently does(n't), (15c)-(iii) - (15c)-(iv).

E doesn't consider this type of example, but given his commitment to the tripartition for (14a), the prediction is that (15c)-(i) should be a complete answer for (15b). But as we just saw, this is not the case. It is instead more plausible that conjunctions like (14a) and (15b) actually do have quadripartite answerhood conditions, but in a case like (14a) replying negatively to the first conjunct addresses the issue raised by both conjuncts (if Emily is not married then there is no need to inquire about her spouse's occupation), so Gricean considerations of quantity apply. This would then be an empirical argument that the tripartition required to capture presupposition filtering should be operative at a pragmatic, not semantic, level.

The purpose of the rest of this response is to show that such a pragmatic theory of projection is indeed possible: it retains a classical bivalent semantics for polar questions, where conjunction is commutative, and derives the projection data for questions and declaratives in a parallel way. We turn to this theory below.

3 ***Limited Symmetry***: The classical system

Limited Symmetry is a novel pragmatic theory of presupposition projection that aims to provide an explanatory and predictive account of the phenomenon.[8] Its main appeal comes from the fact that it derives asymmetric filtering for conjunction but symmetric filtering for disjunction **through a single mechanism** (thus accounting for the experimental results in Kalomoiros & Schwarz (2021, Under review)). As such, the theory can handle contrasts like the following without positing two different filtering mechanisms, one symmetric and one asymmetric (see e.g. Schlenker; Rothschild 2009; 2011):

(16) a. ***Context:*** We have no idea if Emily is married.
b. #Emily's spouse is a doctor and Emily is married
c. ✓Either Emily's spouse is a doctor or Emily is not married.

Here we give a brief introduction to the propositional version of the system. We then proceed to 'lift' the theory to an inquisitive semantics in section 4. We begin with a simple propositional language $\mathcal{L}$ (adapted from Schlenker 2009):

(17) $\phi := \; p_i \mid p'_j p_k \mid \top \mid \; \bot \; \mid \neg\phi \mid (\phi \wedge \phi) \mid (\phi \vee \phi)$ (indices are natural numbers and are omitted below)

The semantics for this language is classical (fully bivalent, with no asymmetry encoded in the semantics). $p'p$ represents an atomic formula with a presuppositional part (p') and a non-presuppositional part (p); the interpretation of these sentences is conjunctive: $p'p$ is true in a world w iff p' is true in w and p is true in w.[9] We will also assume that that $\mathcal{L}$ is expressive enough to have atomic constants for tautologies and and contradictions, $\top$ and $\bot$ respectively.

A core driving force in *Limited Symmetry* is that sentences are parsed from left-to-right, symbol by symbol; the basic symbolic parsing units are: p_i (simple atomic formulas), $p_j p_k$ (presuppositional atomic formulas), $\neg$, $\wedge$, $\vee$, and the parentheses (,). We thus gain access to

[8]Here we present a version of *Limited Symmetry* that is formalized enough to make the main ideas clear, but is not meant to be comprehensive. For a more comprehensive statement of the theory, see Kalomoiros Forthcoming. An even fuller treatment will hopefully be published in the future.

[9]The idea to represent the presupposed content explicitly as separate is directly adopted from Schlenker 2009. The assumption that presuppositions are separable from the other entailments of a sentence is implicit in a lot of work on presupposition. For instance Karttunen 1974 talks about the 'atomic presuppositions' of a sentence. Moreover, presupposition-triggering algorithms (e.g. Abrusán 2011), assume that a presupposition starts as an entailment that gets marked as a presupposition. One then can view the p' in $p'p$ as precisely this entailment to be marked as a presupposition (hence the prime). Nevertheless, it should be noted that this is probably an idealization, and that sometimes separating the entailment which is to be presupposed is not as straightforward (cf. Schlenker 2010). Nonetheless, we think it's a useful idealization, hence we adopt it here.

progressively larger partial syntactic structures. So for a sentence like $(p'p \wedge q)$, we start with the parenthesis (; then we parse $p'p$, then $\wedge$, then q and finally the closing parenthesis. We can collect these **parsing steps/points** in a list: [`(`, `(p'p`, `(p'p ∧`, `(p'p ∧ q`, `(p'p ∧ q)`].[10] The i-th element of such a list for a sentence S will be referred to as the i-th parsing step/point of S, and will be notated as $(S)_i$.

Following a Stalnakerian intuition, at each parsing step we are trying to decide in what worlds in the context C, the sentence is already True or False regardless of continuation. Worlds where a sentence is already false are removed from the context (and the rest of the process continues in the new context where the false worlds have been removed).

For instance, for $S = (p'p \wedge q)$, at parsing step $(S)_3 =$ `(p'p ∧` we know that the sentence is already false in all worlds where $p'p$ is false; it doesn't matter what follows, since we are dealing with a conjunction, which means that as long as we know that the first conjunct is false, the whole conjunction is false.

For any $\mathcal{L}$-sentence S then, at any i-th parsing point $(S)_i$, and for any possible continuation d (good-final, Schlenker 2009) we can define the following sets:

(18)
- $\mathbb{T}_i^S = \{w|\ (S)_i^\frown d\ is\ T\ in\ w\}$ (the set of worlds where S is already true at $(S)_i$, no matter what good final d is concatenated ($^\frown$) to $(S)_i$)
- $\mathbb{F}_i^S = \{w|(S)_i^\frown d\ is\ F\ in\ w\}$ (the set of worlds where S is already false at $(S)_i$, no matter what good final d is concatenated ($^\frown$) to $(S)_i$)

The novel bit in *Limited Symmetry* is how it connects all this to presuppositions. First some notation:

(19) **Substitution:** Given a sentence S, an atomic sentence p_i, and a presuppositional constant $p'_j p_k$ in S, $S[p'_j p_k \mid p_i]$ names a version of S with every instance of $p'_j p_k$ changed to $p'_j p_i$.

For example, if $S = (p'p \wedge q)$, then $S[p'p \mid r] = (p'r \wedge q)$.

(20) $(\mathbf{S})^-$**:** Given a sentence S and any presuppositional constant $p'p$ in S, $(S)^-$ is the version of S with all presuppositional constants changed from $p'p$ to p. If S has no presuppositional constants, then $(S)^- = S$.

For example, if $S = (p'p \wedge q)$, then $(S)^- = (p \wedge q)$. We now define a constraint that presupposition-carrying sentences are subject to:

(21) **Presupposition Constraint:** For all sentences S, any i such that $1 \leq i \leq length(S)$, any presuppositional constants $p'p$ in $(S)_i$ (the i-th parsing point of S), and any good final d, it must hold that for all sentences r:
- $\mathbb{T}_i^{S[p'p \mid r]} \subseteq \mathbb{T}_i^{(S[p'p \mid r])^-}$

  –where $\mathbb{T}_i^{S[p'p \mid r]} = \{w|\ (S[p'p \mid r])_i^\frown d \text{ is } T \text{ in } w\}$
  –and $\mathbb{T}_i^{(S[p'p \mid r])^-} = \{w|\ ((S[p'p \mid r])^-)_i^\frown d \text{ is } T \text{ in } w\}$

[10] We use the `verbatim` font to refer to partial syntactic objects.

- $\mathbb{F}_i^{S[p'p \mid r]} \subseteq \mathbb{F}_i^{(S[p'p \mid r])^-}$

  –where $\mathbb{F}_i^{S[p'p \mid r]} = \{w|\ (S[p'p \mid r])_i^\frown d \text{ is } F \text{ in } w\}$
  –and $\mathbb{F}_i^{(S[p'p \mid r])^-} = \{w|\ ((S[p'p \mid r])^-)_i^\frown d \text{ is } F \text{ in } w\}$

The way this works is that given a presuppositional constant $p'p$ in some i-th parsing point of S, one asks two things: **i)** is it the case that for every r substituting for p in $p'p$ (in S), the set of worlds where $S[p'p \mid r]$ is **already true** at its i-th parsing point $(S[p'p \mid r])_i$, is a subset of the set of worlds where $(S[p'p \mid r])^-$ (the non-presuppositional version of S with r substituting for p in $p'p$) is **already true** at its corresponding i-th parsing point $((S[p'p \mid r])^-)_i$?[11] **ii)** is it the case that for every r substituting for p in $p'p$ (in S), the set of worlds where $S[p'p \mid r]$ is **already false** at its i-th parsing point $(S[p'p \mid r])_i$, is a subset of the set of worlds where $(S[p'p \mid r])^-$ (the non-presuppositional version of S with r substituting for p in $p'p$) is **already false** at its corresponding i-th parsing point $((S[p'p \mid r])^-)_i$? If the answer to both of these questions is positive, then the update continues by removing any worlds where S is already false, moving to the $i+1$ parsing point of S, and repeating the above process. If either of the two conditions receives a negative answer, then the update stops (because of presupposition failure).

An intuitive characterization of the constraint is that presuppositional information should not add ways of making a sentence true or false beyond the ways allowed by the non-presuppositional bit (and this should hold for any non-presuppositional bit[12]); in other words, presuppositions should not add new information.[13]

To make this more concrete, we briefly illustrate how conjunction works in the system: in a conjunction $S = (p'p \wedge q)$, at parsing step $(S)_3 =$ `(p'p` $\wedge$, the following will obtain:

(22) a. For $(S)_3 =$ `(p'p` $\wedge$:
(i) $\mathbb{T}_3^S = \emptyset$ (we cannot yet reason about worlds where S is already true)
(ii) $\mathbb{F}_3^S = \{w \in C|\ p'(w) = 0 \ \ or \ \ p(w) = 0\}$ (S is already false in worlds here $p'p$ fails)

b. For $(S)^- = (p \wedge q)$ (the non-presuppositional version of S), at $((S)^-)_3 =$ `(p` $\wedge$:
(i) $\mathbb{T}_3^{(S)^-} = \emptyset$
(ii) $\mathbb{F}_3^{(S)^-} = \{w \in C|\ \ p(w) = 0\}$

c. Checking the presupposition constraint requires that for all r substituting for p:
(i) $\mathbb{T}_3^{S[p'p \mid r]} \subseteq \mathbb{T}_3^{(S[p'p \mid r])^-}$ (trivial)
(ii) $\mathbb{F}_3^{S[p'p \mid r]} \overset{?}{\subseteq} \mathbb{F}_3^{(S[p'p \mid r])^-}$, i.e., $\{w \in C|\ p'(w) = 0 \ \ or \ \ r(w) = 0\} \overset{?}{\subseteq} \{w \in C|\ \ r(w) = 0\}$

[11]Note how in $((S[p'p \mid r])^-)$ one first substitutes r in $p'p$, and then removes the p'. So if $S = p'p$, then $((S[p'p \mid r])^-) = r$

[12]This is what the quantification over all r substituting for p in $p'p$ accomplishes. Thanks to Phillipe Schlenker (pc) for suggesting this way of strengthening the constraint.

[13]This is conceptually similar to Stalnaker's influential idea that 'x knows that P' presupposes P so that one cannot challenge the assertion in two different ways (Stalnaker 1974); see Kalomoiros 2022 for more details.

The $\mathbb{T}$ sets are empty in this case, as there is no world where it is guaranteed that no matter what second conjunct completes $(S)_3$, the whole sentence will be true (for any given world, many possible second conjuncts will be false). Accordingly, the subsethood constraint is trivially met with regard to these $\mathbb{T}$ sets. The crucial issue is (c-ii): since subsethood needs to hold for all r substituting for p, it needs to hold in the case where r is $\top$. Since a tautology is always true, this amounts to:

(23) $\{w \in C | \; p'(w) = 0\} \overset{?}{\subseteq} \emptyset$

This will hold just in case $\{w \in C | \; p'(w) = 0\} = \emptyset$ which amounts to $C \models p'$.

Consider now the case of $S = (q \wedge p'p)$, where $q \models p'$. At parsing point $(S)_3 =$ `(q` $\wedge$, we know that S is already False in all worlds where q is False. There is no presupposition to check here, so the constraint is trivially met. Crucially, before the update continues, the $\neg q$ worlds are removed from context. So, when it's time to check the constraint at parsing point `(q` $\wedge$ `p'p`, the local context will entail q and hence also p'. So the constraint will be checked successfully. Thus, we derive asymmetric filtering for conjunction.

Crucially, the system predicts symmetry for disjunctions of the form $(p'p \;\vee\; q)$, where $\neg q \models p'$ (i.e. 'bathroom disjunctions', as in (16c)) (see Kalomoiros (Forthcoming); Kalomoiros & Schwarz (Under review); Kalomoiros (2022)). As we will see in section 5, this will systematically lead to symmetry in disjunctions of questions as well (making different predictions from E's account).

4 Limited Symmetry: The inquisitive system

4.1 *Limited Symmetry*$_{inq}$

We now 'lift' *Limited Symmetry* to inquisitive semantics and show how it can account for E's data. We will work with a formal language $\mathcal{L}^+$ that extends $\mathcal{L}$ by adding questions:

(24) $\phi := \; p_i \mid p'_j p_k \mid \top \mid \; \bot \; \mid \neg\phi \mid (\phi \wedge \phi) \mid (\phi \vee \psi) \mid ?\phi$ (indices are natural numbers and are omitted below)

Recall that inquisitive semantics evaluates expressions in states, which are sets of worlds. So now a declarative proposition ϕ will denote a set of states that support ϕ: $\{s | \; s \vdash \phi\}$. We will write $|\phi|$ to denote the classical proposition associated with an $\mathcal{L}^+$-sentence ϕ. Thus, the denotation of ϕ can be written more explicitly as :

(25) $\{s | \; \forall w \in s : \; |\phi| \; is \; T \; in \; w\}$

$p'p$ will denote a set of states that support both p' and p: $\{s | \; s \vdash p \; and \; s \vdash p'\}$. $\top$ denotes the set of all states s (i.e., the power set of W); $\bot$ denotes $\{\emptyset\}$. A polar question $?\phi$ denotes a set of states that support either ϕ or $\neg\phi$. Conjunction is interpreted as set intersection, so $(?\phi \wedge ?\psi)$ is interpreted as $\{s | \; (s \vdash \phi \; or \; s \vdash \neg\phi) \; and \; (s \vdash \psi \; or \; s \vdash \neg\psi)\}$. Disjunction is interpreted as set union. Finally, note that any set of states that supports an $\mathcal{L}^+$-sentence ϕ will include the empty state $\emptyset$, as trivially it holds that for every world w in $\emptyset$, $|\phi|$ is true in w. So far, this is a garden-variety inquisitive semantics for $\mathcal{L}^+$.

The core step is to lift the $\mathbb{T}/\mathbb{F}$ concept to this new semantics. Recall that the intuition for the classical system had to do with computing worlds where a sentence was already True/ False. We need to retain this for $\mathcal{L}^+$ sentences that contain no $?\phi$ formulas, and hence are declaratives. We do this for an inquisitive declarative sentence ϕ by computing the set of states that support ϕ no matter the continuation.

What is the corresponding intuition for polar questions? States in inquisitive semantics formalize the idea of classes of possible worlds where we can resolve a question. So, one starting point would be to try to define sets of states where a question is resolved regardless of possible continuation. However, full resolution can be given only when one has access to the full question. We want to be able to reason about questions with partial syntactic structures like `(?p` $\wedge$. To achieve this we need to adopt a weaker notion: whether the resolution is overall positive or negative.

Consider for instance the following coordination of polar questions:

(26) Is Freedonia located in Europe and is it a nice place?

Recall E's data in (14b)-(14d) about the possible answers to a conjunction of polar questions. The point was that knowing that the proposition underlying the first conjunct is false is enough to make one resolve the question negatively. To further see that sets of states can be characterized as resolving a question positively or negatively, consider the following paradigm of responses to (26) in different possible states:

(27)
a. Yes (**state:** Freedonia is located in Europe and it is a nice place)
b. No/# Yes (**state:** Freedonia is not located in Europe and it is a nice place)
c. No/# Yes (**state:** Freedonia is located in Europe but it is not a nice place)
d. No/# Yes (**state:** Freedonia is not located in Europe and it is not a nice place)

While one-word yes/no answers are slightly weird, the judgment is clear that in each of the described states, there is one 'correct' yes/no response. This data then suggests that the calculus of polarity for a conjunction of polar questions follows a conjunction-style logic. As long as you know that the declarative underlying the first conjunct fails in s, then s can be seen as representing an overall negative resolution.[14] From our point of view this is interesting because it means that we can start reasoning about overall polarity for a given state, even if we do not have access to all the parts of the question. For example, at the point `(?p` $\wedge$, we can already isolate states where the proposition p fails; hence, in those states, these states can be seen as resolving the question negatively, regardless of what the second conjunct is (i.e., even though we don't know what the resolution exactly consists in since we lack access to the whole question, we know that any potential resolution is negative).

All this suggests the following way of extending the *Limited Symmetry* intuitions to polar questions: given a question ϕ, at parsing point $(\phi)_i$ try and see if you can isolate states that are positive or negative with respect to the question, regardless of continuation. To do this, one needs access to the declaratives underlying the question, i.e. to the version of S where all the question operators have been removed. Let's denote this version as $Decl(S)$, and define it inductively as follows:[15]

[14]Note that the direction of the logic here: If you can answer 'Yes', or 'No' to a question Q in a given state s diagnoses polarity in that state; not being able to give a yes/no response in a given state s tells us nothing about the overall polarity in s.

[15]$Decl(Q)$ can be seen as a simplified version of the discourse referent that Roelofsen & Farkas 2015 take

(28) For any $\mathcal{L}^+$ sentence ϕ:
(i) If $\phi := p$, then $Decl(\phi) = p$
(ii) If $\phi := p'p$, then $Decl(\phi) = p'p$
(iii) If $\phi := \top$, then $Decl(\phi) = \top$
(iv) If $\phi := \bot$, then $Decl(\phi) = \bot$
(v)If $\phi :=?\psi$, then $Decl(\phi) = \psi$
(vi) If $\phi := \psi \wedge \chi$, then $Decl(\phi) = Decl(\psi) \wedge Decl(\chi)$
(vii) If $\phi := \psi \vee \chi$, then $Decl(\phi) = Decl(\psi) \vee Decl(\chi)$

Now the corresponding sets for $\mathbb{T}$ and $\mathbb{F}$ can be defined as follows:

(29) For any S, any i, $1 \leq i \leq length(S)$, and any good-final d:
a. $\mathbb{P}(os)$: $\{s |\ s \vdash Decl(\ (S)_i^\frown d\ )\}$
b. $\mathbb{N}(eg)$: $\{s |\ s \vdash \neg Decl(\ (S)_i^\frown d\ )\}$

The inquisitive version of *Limited Symmetry* then is that as you are parsing a question from left to right, you try to determine as fast as possible in what sets of worlds (states) of the context the question receives a positive or negative overall answer regardless of continuation. Note that these will not be answers that resolve the question completely; rather they will be answers that are determined only as far as their overall polarity goes. The point is that such 'overall polarity' calculations can happen even if the parser doesn't have access to the whole question. In the original *Limited Symmetry* system, if a set of worlds was calculated to make a sentence False, then that set was removed from the context. Since now we are reasoning about determining the overall polarity of a response to a question $?\phi$, the corresponding requirement is as follows: once you know that a set of states determines a certain kind of polarity for a response to $?\phi$, then future polarity calculations do not take that set of states into account (nothing is removed from the contexts here, and the requirement is symmetric between positive and negative polarity).[16]

The claim is then that presuppositions matter when making these online polarity calculations. So, a 'lifted' version of our presupposition constraint can be stated:[17]

(30) **Presupposition Constraint:** For all sentences S, any i such that $1 \leq i \leq length(S)$, any presuppositional constants $p'p$ in $(S)_i$ (the i-th parsing point of S), and any good final d, it must hold that for all r:
- $\mathbb{P}_i^{S[p'p\ |\ r]} \subseteq \mathbb{P}_i^{(S[p'p\ |\ r])^-}$

polar questions to introduce. Their idea is that in determining the polarity of a response R to a polar question Q, one checks whether R agrees with a propositional discourse referent introduced by Q. In their system, that discourse referent is determined via the possibilities that Q **highlights**. Since Roelofsen & Farkas 2015 are interested in accounting for the distribution of polarity particles, their definition of **highlights** leads to more complicated objects than our own $Decl(Q)$ (see their paper for details). It would be an interesting exercise to try and combine *Limited Symmetry* with their system, but given that $Decl(Q)$ suffices for our purposes, this exercise lies beyond the scope of the current response.

[16]Note that this is actually a choice point for the theory. If one were to stick as closely as possible to the classical *Limited Symmetry* system, then the requirement would be to stop considering states where the polarity has been fixed **negatively** for all possible continuations. However, I can see no motivation for this kind of constraint in the case of polarity calculations.

[17]For the constraint in (30) to be fully defined one needs to extend the definitions of $(\mathbf{S})^-$ and **Substitution** to L^+. Since the extension is routine, we leave it implicit.

–where $\mathbb{P}_i^{S[p'p \mid r]} = \{s \mid s \vdash Decl(\ (S[p'p \mid r])_i^\frown d\ )\}$
–and $\mathbb{P}_i^{(S[p'p \mid r])^-} = \{s \mid s \vdash Decl(\ ((S[p'p \mid r])^-)_i^\frown d\ )\}$

- $\mathbb{N}_i^{S[p'p \mid r]} \subseteq \mathbb{N}_i^{(S[p'p \mid r])^-}$

–where $\mathbb{N}_i^{S[p'p \mid r]} = \{s \mid s \vdash \neg Decl(\ (S[p'p \mid r])_i^\frown d\ )\}$
–and $\mathbb{N}_i^{(S[p'p \mid r])^-} = \{s \mid s \vdash \neg Decl(\ ((S[p'p \mid r])^-)_i^\frown d\ )\}$

Note how everything presupposition-related happens at the level of incrementally computing polarity. The semantics has remained entirely classical. We now turn to applying *Limited Symmetry*$_{inq}$ to E's data.

4.2 Conjoined polar questions

Consider first $S = (?p'p \wedge ?q)$. The first parsing point where we can start reasoning about the overall polarity of possible responses is $(S)_4 =$ `(?p'p` $\wedge$, when we know that we are dealing with a conjunction.[18] To check the presupposition constraint, we must first reason about states which for all d support either $Decl(\ (?p'p \wedge {}^\frown\ d\ )$ (positive) or $\neg Decl(\ (?p'p \wedge {}^\frown\ d\ )$ (negative). Since, *Decl* removes ?-operators, this means finding states that support either $(p'p \wedge {}^\frown\ d$ or $\neg(p'p \wedge {}^\frown\ d$, for any good-final d that contains no ?-operators:

(31) For $(S)_4 =$ `(?p'p` $\wedge$:
a. $\mathbb{P}_4^S = \{\emptyset\}$ (only the empty set of worlds is such that every world in it makes $|p'p|$ true)[19]
b. $\mathbb{N}_4^S = \{s \mid s \vdash \neg p\ or\ s \vdash \neg p'\}$ (where the declarative underlying the first conjunct fails, the question receives a negative polarity response regardless of continuation)

We also need access to the corresponding sets for $((?p'p \wedge ?q))^- = (?p \wedge ?q)$ (the version of the sentences with the presuppositions removed), at the corresponding parsing point $((S)^-)_4 =$ `(?p` $\wedge$:

(32) For $((S)^-)_4 =$ `(?p` $\wedge$:
a. $\mathbb{P}_4^{(S)^-} = \{\emptyset\}$
b. $\mathbb{N}_4^{(S)^-} = \{s \mid s \vdash \neg p\}$

We can now check the presupposition constraint, by reasoning about these sets for all r substituting for p in S.

(33) For all r:
a. $\mathbb{P}_4^{S[p'p \mid r]} = \{\emptyset\}$
b. $\mathbb{N}_4^{S[p'p \mid r]} = \{s \mid s \vdash \neg r\ or\ s \vdash \neg p'\}$

[18]We count ?-operators as a basic parsing unit.
[19]Recall that $|\phi|$ is the classical proposition associated with inquisitive ϕ.

(34) For all r:

a. $\mathbb{P}_4^{(S[p'p \mid r])^-} = \{\emptyset\}$

b. $\mathbb{N}_4^{(S[p'p \mid r])^-} = \{s \mid s \vdash \neg r\}$

Thus, comparing between S and $(S)^-$ at this point, we ask whether for all r:

(35) a. $\mathbb{P}_4^{S[p'p \mid r]} \subseteq \mathbb{P}_4^{(S[p'p \mid r])^-}$

b. $\mathbb{N}_4^{S[p'p \mid r]} \subseteq \mathbb{N}_4^{(S[p'p \mid r])^-}$

It is obvious that $\mathbb{P}_4^{S[p'p \mid r]} \subseteq \mathbb{P}_4^{(S[p'p \mid r])^-}$. For the $\mathbb{N}$ sets we reason as follows: take $r = \top$; Then, $\{s \mid s \vdash \neg\top\} = \{\emptyset\}$, so we can rewrite the $\mathbb{N}$ sets as:

(36) a. $\mathbb{N}_4^{S[p'p \mid r]} = \{s \mid s \vdash \neg p'\} \cup \{\emptyset\} = \{s \mid s \vdash \neg p'\}$

b. b. $\mathbb{N}_4^{(S[p'p \mid r])^-} = \{\emptyset\}$

Recall that the empty state is already a member of $\{s \mid s \vdash \neg p'\}$. Hence $\mathbb{N}_4^{S[p'p \mid r]} = \{s \mid s \vdash \neg p'\}$. So, for $\mathbb{N}_4^{S[p'p \mid r]}$ to be a subset of $\mathbb{N}_4^{(S[p'p \mid r])^-}$ it needs to hold that $\{s \mid s \vdash \neg p'\} = \{\emptyset\}$. This can only happen if there are no subsets of the contexts where p' is supported, i.e if $C \models p'$. Hence, the sentence is associated with a presupposition, which must be entailed by the context to make the constraint hold (just like the declarative case).

Consider now $S = (?q \wedge ?p'p)$, where $q \models p'$. Both $(S)_4$ and $((S)^-)_4 =$ `(?q` $\wedge$, so the subsethood constraint will hold here as $\mathbb{P}$ and $\mathbb{N}$ will not differ between S and $(S)^-$. But now $\{s \mid s \vdash \neg q\}$ has been determined as fixing a negative polarity to responses to the question, so it is removed from consideration for subsequent polarity calculations. Therefore, attention is focused on states the support q (both for positive and for negative polarity). The parse then moves on to $(S)_6 =$ `(?q` $\wedge$ `?p'p`; now we can reason about states where the question receives both a positive and a negative polarity response:

(37) For $(S)_6 =$ `(?q` $\wedge$ `?p'p`, for all r:

a. $\mathbb{P}_6^{S[p'p \mid r]} = \{s \mid s \vdash q \textit{ and } s \vdash r \textit{ and } s \vdash p'\}$

b. $\mathbb{N}_6^{S[p'p \mid r]} = \{s \mid s \vdash q \textit{ and } s \vdash \neg p'r\} =$
$\{s \mid (s \vdash q \textit{ and } s \vdash \neg p') \textit{ or } (s \vdash q \textit{ and } s \vdash \neg r)\}$

(38) For $((S)_6^-) =$ `(?q` $\wedge$ `?p`, for all r:

a. $\mathbb{P}_6^{(S[p'p \mid r])^-} = \{s \mid s \vdash q \textit{ and } s \vdash r\}$

b. $\mathbb{N}_6^{(S[p'p \mid r])^-} = \{s \mid s \vdash q \textit{ and } s \vdash \neg r\}$

(39) For all r, we require:

a. $\mathbb{P}_6^{S[p'p \mid r]} \subseteq \mathbb{P}_6^{(S[p'p \mid r])^-}$

b. $\mathbb{N}_6^{S[p'p \mid r]} \subseteq \mathbb{N}_6^{(S[p'p \mid r])^-}$

The subsethood between $\mathbb{P}_6^{S[p'p \mid r]}$ and $\mathbb{P}_6^{(S[p'p \mid r])^-}$ is clear. For the $\mathbb{N}$ sets, note that $\{s \mid s \vdash q \textit{ and } s \vdash \neg p'\} = \{\emptyset\}$ (as $q \models p'$ by hypothesis, so only the empty state qualifies as supporting both q and $\neg p'$). Thus, we can rewrite the $\mathbb{N}$ sets as:

(40) a. b. $\mathbb{N}_6^{S[p'p \mid r]} = \{\emptyset\} \cup \{s|\ s \vdash q \textit{ and } s \vdash \neg r\}$
b. $\mathbb{N}_6^{(S[p'p \mid r])^-} = \{s|\ s \vdash q \textit{ and } s \vdash \neg r\}$

The empty state $\emptyset$ is trivially a member of $\{s|\ s \vdash q \textit{ and } s \vdash \neg r\}$. Hence, $\mathbb{N}_6^{S[p'p \mid r]} \subseteq \mathbb{N}_6^{(S[p'p \mid r])^-}$. Therefore, there is no parsing point at which the constraint is violated, and thus the sentence does not suffer presupposition failure. So, we have just derived that conjunctions of polar questions behave asymmetrically modulo presupposition projection while keeping the underlying semantics of polar questions fully symmetric and bivalent!

Finally, note how the parsing-oriented reasoning we have developed **derives** E's tripartition at the pragmatic level: at parsing point $(S)_4 =$ `(?q` $\wedge$ we know that the question receives a negative polarity answer in $\{s|\ s \vdash \neg q\}$. These are then removed from further consideration in further polarity calculations. Then, $(S)_6 =$ `(?q` $\wedge$`?p'p` we calculate $\{s|s \vdash q \textit{ and } s \vdash p \textit{ and } s \vdash p'\}$ as determining a positive polarity answer; finally, we calculate $\{s|\ s \vdash q \textit{ and } s \vdash \neg p'p\}$ as determining a negative polarity answer. If for each one of these sets we consider its maximal subset, then we get alternatives corresponding to $\{\neg q,\ q \wedge p'p,\ q \wedge \neg p'p\}$, which is exactly E's tripartition.

4.3 Negative polar questions

Consider now the issue of negative polar questions:

(41) #Is Emily unmarried and is her spouse a doctor? $\rightsquigarrow (?(\neg q) \wedge ?p'p),\ q \models p'$.

At parsing point $(S)_7 =$ `(?(¬q)` $\wedge$, we can determine a $\mathbb{N} = \{s|\ s \vdash q\}$, where the question receives a negative polarity response regardless of continuation. These states are then removed from subsequent consideration for polarity calculations. We move on to $(S)_9 =$ `(?(¬q)` $\wedge$ `?p'p`:

(42) a. $\mathbb{P}_9^S = \{s|s \vdash \neg q \textit{ and } s \vdash p \textit{ and } s \vdash p'\}$
b. $\mathbb{N}_9^S = \{s|\ s \vdash \neg q \textit{ and } s \vdash \neg p'p\}$

(43) For $((S)^-)_9 =$ `(?(¬q)` $\wedge$ `?p`:
a. $\mathbb{P}_9^{(S)^-} = \{s|\ s \vdash \neg q \textit{ and } s \vdash p\}$
b. $\mathbb{N}_9^{(S)^-} = \{s|\ s \vdash \neg q \textit{ and } s \vdash \neg p\}$

For all r substituting for p, $\mathbb{P}_9^{S[p'p|r]} \subseteq \mathbb{P}_9^{(S[p'p|r])^-}$ (to see this fully, replace p with r in the sets above). But consider the $\mathbb{N}$ sets:

(44) For all r:
a. $\mathbb{N}_9^{S[p'p|r]} = \{s|\ s \vdash \neg q \textit{ and } s \vdash \neg p'r\} =$
$\{s|\ (s \vdash \neg q \textit{ and } s \vdash \neg p') \textit{ or } (s \vdash \neg q \textit{ and } s \vdash \neg r)\}$
b. $\mathbb{N}_9^{(S[p'p|r])^-} = \{s|\ s \vdash \neg q \textit{ and } s \vdash \neg r\}$

Since, $q \models p'$ doesn't guarantee that $\neg q \models p'$ (or that $\neg p' \models q$), we can no longer just take $\{s|\ s \vdash \neg q \textit{ and } s \vdash \neg p'\}$ as equivalent to $\{\emptyset\}$; instead we need the context to guarantee that, by having only worlds where either $|q \vee p'|$ holds. Since $q \models p'$, this boils down to the requirement that $C \models p'$. We thus derive that (41) comes with a presuppositional requirement that $C \models p'$ (which makes it different from (5b) that comes with no such requirement) Therefore, in the absence of the right context/out of the blue, the infelicity that (41) shows is expected.

In this way, the asymmetry between positive and negative polar questions in conjunction that E points out falls out in our system. More broadly, the point is that even though $?p$ and $?(\neg p)$ receive the same inquisitive denotation, they are mapped to different $\mathbb{P}/\mathbb{N}$ sets: $\mathbb{P}^{?p} = \{s|s \vdash p\}$, but $\mathbb{P}^{?(\neg p)} = \{s|s \vdash \neg p\}$ (and the reverse for the $\mathbb{N}$ sets).

4.4 'or not' questions

The final conjunction-related piece of data that we need to account for is the case of 'or not' questions:

(45) #Is Emily married or not, and is her spouse a doctor?

The first conjunct could receive an analysis either as $(?p \vee ?(\neg p))$ or $?(p \vee (\neg p))$, depending on what we take 'or not' to elide (a full question or just a declarative). E assumes the former analysis. However, the issue is orthogonal to our purposes, as either analysis leads to the same conclusion; the reason is that $Decl(?(p \vee q)) = Decl((?p \vee ?q)) = (p \vee q)$.

On the $(?p \vee ?(\neg p))$ analysis, the sentence is $S = ((?p \vee ?(\neg p)) \wedge q'q)$, with $p \models q'$; at parsing point $(S)_{12} = \texttt{((?p} \vee \texttt{?(}\neg\texttt{p))} \wedge$, we know that we are dealing with a conjunction. Hence we can try to calculate a $\mathbb{N}$, which will be the set of states where the declarative underlying the first conjunct fails:

(46) $\mathbb{N}^{S}_{12} = \{s|\ s \vdash \neg p \textit{ and } s \vdash p\} = \{\emptyset\}$

What (46) says is that only the empty state fixes the polarity to an answer of this question as negative, at this point in the parse. The first conjunct carries no presuppositions, so the presupposition constraint is met. We parse the rest, and get access to $(S)_{13} = \texttt{((?p} \vee \texttt{?(}\neg\texttt{p))} \wedge \texttt{q'q}$. Reasoning about the $\mathbb{N}$ is enough to show that (45) is associated with a presupposition:

(47) a. $(S)_{13} = \texttt{((?p} \vee \texttt{?(}\neg\texttt{p))} \wedge \texttt{q'q}$:
b. $\mathbb{N}^{S}_{13} = \{s|\ (s \vdash \neg p \textit{ and } s \vdash p) \textit{ or } (s \vdash \neg q' \textit{ or } s \vdash \neg q)\}$

Note that $\{s|\ s \vdash \neg p \textit{ and } s \vdash p\} = \{\emptyset\}$, thus:

(48) $\mathbb{N}^{S}_{13} = \{\emptyset\} \cup \{s|\ s \vdash \neg q' \textit{ or } s \vdash \neg q\} = \{s|\ s \vdash \neg q' \textit{ or } s \vdash \neg q\}$

For $(S)^{-}$, the corresponding $\mathbb{N}$ at $((S)^{-})_{13} = \texttt{((?p} \vee \texttt{?(}\neg\texttt{p))} \wedge \texttt{q}$ is:

(49) $\mathbb{N}^{(S)^{-}}_{13} = \{s|\ s \vdash \neg q\}$

Since now there is a presuppositonal bit, we need to check whether the constraint is met:

(50) For all r:
a. $\mathbb{N}^{S[q'q\ |\ r]}_{13} = \{s|\ s \vdash \neg q' \textit{ or } s \vdash \neg r\}$
b. $\mathbb{N}^{(S[q'q\ |\ r])^{-}}_{13} = \{s|\ s \vdash \neg r\}$

c. $\mathbb{N}_{13}^{S[q'q \mid r]} \overset{?}{\subseteq} \mathbb{N}_{13}^{(S[q'q \mid r])^-}$

There is nothing to guarantee here that $\{s| \; s \vdash \neg q'\}$ contains only the empty state (which would be needed to guarantee subsethood for all r substituting for q); instead we need the context to entail q'. Thus, (45) is predicted to be associated with a presupposition (and hence infelicitous unless the context satisfies that presupposition) (essentially the same explanation E gives, but derived from the general principles of *Limited Symmetry*).

4.5 Interim summary

Summing up, we have shown how *Limited Symmetry* can be naturally extended to an inquisitive version, capturing the asymmetry of filtering in conjunctions of polar questions: presuppositions in the second conjunct of a conjoined polar question can be filtered if entailed by the (declarative underlying) the first conjunct; presuppositions in the first conjunct of a conjoined polar questions must be entailed by the global context. At the same time, we have shown how negative polar questions, $?(\neg p)$ and 'or not' questions, $?p \vee ?(\neg p)$, do not behave equivalently to their positive counterpart, $?p$, in terms of presupposition filtering, even though they have the same inquisitive denotations: whereas $?p$ as a first conjunct can lead to filtering of a presupposition of $?q$ in $(?p \wedge ?q)$, this is not so for $?(\neg p)$ and $(?p \vee ?(\neg p))$; instead, both $(?(\neg p) \wedge ?q)$ and $((?p \vee ?(\neg p)) \wedge ?q)$ need the presuppositions of q to be established in the context, otherwise they are infelicitous. So, we have derived all of E's conjunction data within the inquisitive extension of *Limited Symmetry*, without moving from a bivalent to a trivalent semantics for questions, and without baking any asymmetries in the semantics. We now turn to our final topic: the system's predictions for disjunctions.

5 Disjoined polar questions

E points out that the phenomenon of projection in coordinations of polar questions extends to disjunctions; he gives a judgment whereby projection from disjunctions follows the same pattern as projection form conjunction (see also fn 2):

(51) a. ***Context:*** We have no idea whether or not Emily is married, but whenever we see her, she's alone.
b. Is Emily unmarried or is her spouse away?
c. ??Is Emily's spouse away or is she unmarried?

The judgment for (51b) is uncontroversial and parallels the judgment for the declarative version of such disjunctions, where a presupposition in the second disjunct is filtered if the negation of the first disjunct entails that presupposition (Karttunen, 1973). However, as it has been discussed extensively in the literature on projection, disjunctions appear symmetric: it doesn't matter whether or not it is the first or second disjunct whose negation entails the presuppositions of the other disjunct; both cases in (52) appear fine (cf. Partee's 'Bathroom sentences', see also Schlenker 2009):

(52) a. ***Context:*** We have no idea whether or not the house we are in has a bathroom, but we can't seem to find one.

b. ✓Either there is no bathroom or the bathroom is in a weird place.
c. ✓Either the bathroom is in a weird place or there is no bathroom.

In this respect, declarative disjunctions differ from conjunctions modulo their projection properties, with this conclusion recently receiving experimental support (Kalomoiros & Schwarz, 2021, Under review). To the extent that we are dealing with parallel phenomena, we would expect this difference to carry over to disjunctions of polar questions; nevertheless, E reports an asymmetry in judging (51c) infelicitous, and builds this asymmetry in his trivalent semantics for disjunction (although he acknowledges the complexity of the issue, and points out that one could move to a Strong Kleene truth table that would give symmetric disjunction).[20] The results of our own informal survey of native speakers suggest no difference between (51b) and (51c). But in the absence of more fine-grained experimental data of the kind found in Kalomoiros & Schwarz (Under review), we are unwilling to take a strong stance on this.

Here we will merely spell out the predictions of our system for disjunction. A complicating factor is that disjunctive polar questions come in two sorts: *open* and *closed* (Roelofsen & Farkas 2015):

(53) a. Does Mary like cats$^{\uparrow}$ or does she like dogs$^{\uparrow}$? (Open)
b. Does Mary like cats$^{\uparrow}$ or does she like dogs$^{\downarrow}$? (Closed)

Open disjunctive questions have rising intonation on both disjuncts. The issue they raise can be resolved by affirming the first disjunct, the second disjunct, or the negation of both disjuncts: Mary likes cats, Mary likes dogs, Mary likes neither. Closed disjunctive questions on the other hand, have rising intonation on the first disjunct, but falling intonation on the second; they are taken to presuppose *exhaustiveness* (i.e. that Mary likes either cats or dogs; no other option is possible), and *exclusivity* (i.e. that Mary liking neither cats nor dogs does not obtain). Since E argues that the presupposition facts do not vary across these two types, we apply our system to both of them.

Let's start with the open disjunctions. While the syntax of (51) might suggest a translation like $(?p \vee ?q)$, it has been argued that this gives the wrong resolution conditions (Hoeks & Roelofsen 2020). $(?p \vee ?q)$ suggests that being (for instance) in a state that supports that 'Mary doesn't like cats' would be enough to resolve the issue raised by (53a); as Hoeks & Roelofsen 2020 point out that this doesn't seem correct; instead they contend that the correct resolution conditions are given by $?(p \ \vee \ q)$: the issue is resolved by states that support p, states that support q and states that support neither p nor q (see also fn 22). However, this debate is orthogonal with regards to our approach, since $Decl((?p \vee ?q)) = Decl(?(p \ \vee \ q)) = Decl((p \ \vee \ q)) = (p \ \vee \ q)$. In all cases, a prediction of symmetric filtering is made (as long the negation of the non-presuppositional disjunct entails the presuppositions of the other disjunct). We illustrate with $S = (?p'p \vee ?q)$, where $\neg q \models p'$:

(54) At $(S)_4 =$ `(?p'p` $\vee$, $\mathbb{P}$ look at follows:
a. $\mathbb{P}_4^S = \{s| \ s \vdash p \ and \ s \vdash p'\}$
b. $\mathbb{P}_4^{(S)^-} = \{s| \ s \vdash p\}$

[20] Of course the issue here is the justification. The Strong Kleene truth table for conjunction is also symmetric, but experimental results suggest that projection is rigidly asymmetric in conjunction (Mandelkern et al. 2020). This is exactly the justification that *Limited Symmetry* aims to provide by deriving symmetric disjunction, but asymmetric conjunction.

Since for all r, $\mathbb{P}_4^{S[p'p \mid r]} \subseteq \mathbb{P}_4^{(S[p'p \mid r])^-}$, our presupposition constraint holds.

(55) At $(S)_4 =$ `(?p'p` $\vee$, $\mathbb{N}$ look as follows:

a. $\mathbb{N}_4^S = \mathbb{N}_4^{(S)^-} = \{\emptyset\}$ (only the empty state supports $\neg(p'p \vee d$, for any good final d)

Again, the constraint is satisfied. Since states where $p'p$ is True fix a positive polarity for S, they are disregarded for subsequent polarity calculations for S and $(S)^-$. This means that we can restrict the next $\mathbb{P}/\mathbb{N}$ sets for S and $(S)^-$ to $\neg p'p$ states:

(56) At $(S)_5 =$ `(?p'p` $\vee$ `?q`, for all r

a. $\mathbb{P}_5^{S[p'p \mid r]} = \{s|\ s \vdash p'r\ \mathit{or}\ s \vdash q\} \cap \{s|\ s \vdash \neg p'p\}$

b. $\mathbb{P}_5^{(S[p'p \mid r])^-} = \{s|\ s \vdash r\ \mathit{or}\ s \vdash q\} \cap \{s|\ s \vdash \neg p'p\}$

$\mathbb{P}_{t_5}^{S[p'p \mid r]}$ can be rewritten as:

(57) $\mathbb{P}_5^{S[p'p \mid r]} = \{s|\ (s \vdash p'\ \mathit{or}\ s \vdash q)\ \mathit{and}\ (s \vdash r\ \mathit{or}\ s \vdash q)\} \cap \{s|\ s \vdash \neg p'p\}$

Clearly then, for all r, $\mathbb{P}_5^{S[p'p \mid r]} \subseteq \mathbb{P}_5^{(S[p'p \mid r])^-}$; hence, no violation of the constraint. Let's move on to the $\mathbb{N}$ sets:

(58) At $(S)_5 =$ `(?p'p` $\vee$ `?q`, for all r:

a. $\mathbb{N}_5^{S[p'p \mid r]} = \{s|\ s \vdash \neg p'r\ \mathit{and}\ s \vdash \neg q\} \cap \{s|\ s \vdash \neg p'p\} =$
$\{s|\ (s \vdash \neg p'\ \mathit{and}\ s \vdash \neg q)\ \mathit{or}\ (s \vdash \neg r\ \mathit{and}\ s \vdash \neg q)\} \cap \{s|\ s \vdash \neg p'p\}$

b. $\mathbb{N}_5^{(S[p'p \mid r])^-} = \{s|\ s \vdash \neg r\ \mathit{and}\ s \vdash \neg q\} \cap \{s|\ s \vdash \neg p'p\}$

Note that since $\neg q \models p'$, $\{s|\ s \vdash \neg p'\ \mathit{and}\ s \vdash \neg q\} = \{\emptyset\}$. Since the empty state is part of any set of states we have:

(59) $\mathbb{N}_5^{S[p'p \mid r]} = (\{\emptyset\} \cup \{s|s \vdash \neg r\ \mathit{and}\ s \vdash \neg q\}) \cap \{s|\ s \vdash \neg p'p\} =$
$\{s|\ s \vdash \neg r\ \mathit{and}\ s \vdash \neg q\} \cap \{s|\ s \vdash \neg p'p\}$

Thus, $\mathbb{N}_5^{S[p'p \mid r]} = \mathbb{N}_5^{(S[p'p \mid r])^-}$; this holds for all r substituting for p, hence our constraint is not violated. As there is no point where the constraint is violated, no presupposition failure is predicted, and symmetric filtering is derived.

Regarding closed disjunctive questions, Hoeks & Roelofsen 2020 analyse them as $(p\ \vee\ q)$ in an inquisitive framework; E analyses them as a species of $(?p \vee ?q)$, where an positivity operator applies and gets rid of the negative answers. Either way, since $\mathit{Decl}(p\ \vee\ q) = \mathit{Decl}((?p \vee ?q))$ the calculation for open disjunctions above works in exactly the same way, predicting symmetry.[21] [22]

[21]I take no position here on the correct analysis for closed disjunctive questions, as it is beyond the scope of the projection facts.

[22] I want to point out the following possibility. Suppose that one analyses disjunctive questions in inquisitive semantics as $(?p \vee ?q)$. We saw earlier that this does not produce good resolution conditions. However, if we constrain resolution conditions to resolve a question positively or negatively (i.e. to be subsets of either a $\mathbb{P}$ set or a $\mathbb{N}$ set), then something like $\{s|\ s \vdash \neg p\}$ will not qualify, as states that support $\neg p$ are found both in $\mathbb{P}$ and $\mathbb{N}$ ($\{s|\ s \vdash \neg p\ \mathit{and}\ s \vdash q\}$, $\{s|\ s \vdash \neg p\ \mathit{and}\ s \vdash \neg q\}$ respectively). Thus, under this assumption, the

6 Conclusion

This paper presented a response to the challenge identified by Enguehard 2021 regarding the generalization of projection patterns to coordinations of polar questions: we argued, contra Enguehard 2021, that the data can be handled without moving to a trivalent inquisitive denotation for questions that semanticizes the various (a)-symmetries of projection. Instead, it is enough to generalize the *Limited Symmetry* approach to classical inquisitive question denotations, by reasoning about the overall polarity of a response to a given question. Seen from a high-level perspective, the idea was that linear order has a role to play in how we reason about polarity to possible responses: for a conjunction, knowing that the declarative underlying the first conjunct is false determines the overall polarity of the response as negative, no matter the second conjunct. If we take presuppositions to be operative at this level of reasoning (as formalized with our extension of *Limited Symmetry*), then the conjunction data fall out. Furthermore, we make a prediction that disjunctions of polar questions should show symmetry (just like their declarative counterparts, although as noted the issue is empirically complex). Thus, *Limited Symmetry* represents an approach to presupposition projection that scales nicely to questions in a way that is fully general and explanatory.

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