Proceedings of SALT 25: 328-345, 2015

Bias in Commitment Space Semantics: Declarative questions, negated questions, and question tags*

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Abstract The paper introduces a formal framework of communication that captures not only information that is agreed upon by the interlocutors, but also the projected continuations of the communicative exchange. It allows for modeling conjunction, disjunction and denegation of speech acts. Assertions are analyzed as commitments of interlocutors for the truth of propositions. Questions are conversational moves that restrict the continuations to assertions by the other participant; this allows for a modeling of questions that restricts continuations to just one assertion. The framework is applied to biased questions, to questions with high and low negation, and to two types of question tags.

Keywords: speech act, assertion, question, bias, conjunction, disjunction, question tags

1 A framework for illocutionary acts

With performing a speech act, a speaker produces a communicative effect, the illocutionary act. Such acts change the social relations and obligations of the interlocutors; for example, with an assertion, the speaker declares a commitment to the truth of a proposition. Hence, speech acts are transitions, or functions, from world/time pairs to world/time pairs (cf. Szabolcsi 1982; Krifka 2014). In the current paper I will develop a formal model that captures certain aspects of such changes, based on Cohen & Krifka (2014). Its crucial property is that it concerns not only the commitments that have accrued up to the current point in conversation, but also their licit future developments. This component will be essential for the modeling of the three empirical phenomena this paper deals with: questions – especially biased questions – negation of questions, and question tags.

The fundamental notion of the model is the **commitment state**, modeled as a set of propositions. This set contains the propositions that are publicly shared by

* This work was supported by *Bundesministerium für Bildung und Forschung* (Förderkennzeichen 01UG0711) and *Deutsche Forschungsgemeinschaft* (SFB 632 Informationsstruktur). For helpful comments, I thank the audiences at SALT25 and at talks at ZAS Berlin, the Universities of Amsterdam, Cologne, and Austin, as well as the SIAS Summer Institute in Berlin.

the participants. The basic function of speech acts is to change a commitment state. I will write $\mathfrak{A}_\varphi$ for an illocutionary act that adds the proposition φ to the commitment state c, using graphical notation as in Figure 1.

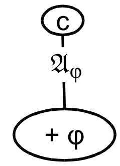

Figure 1:
Update of commitment state

(1) Update of commitment state c with speech act $\mathfrak{A}_\varphi$
$c + \mathfrak{A}_\varphi = c \cup \{\varphi\}$.

There are certain requirements for pragmatically licit updates. Ideally, the proposition φ is **not entailed** by c; otherwise, φ would be redundant. More importantly, the proposition φ should be **consistent** with the propositions in c. We cannot require consistency as a strict condition, as speakers often have inconsistent beliefs, but there should not be any blatant inconsistencies, like a proposition and its negation being part of the same commitment state.

The notion of commitment states and their possible continuations naturally leads to the modeling of an information state in discourse that includes the expected or "legal" continuations of a commitment state. I call this a **commitment space** (CS); it is modeled as a set of commitment states.

(2) C is a commitment space if C is a set of commitment states,
$\cap C \neq \varnothing$ and $\cap C \in C$

We call $\cap C$ the **root** of C, and write $\surd C$. It is the set of all propositions that the participants have positively committed to up to the current point in conversation.

The notion of update of a commitment state by an illocutionary act can be generalized to commitment spaces, as in (3):

(3) Update of a commitment space with an illocutionary act $\mathfrak{A}$, where $\mathfrak{A}$ is defined for commitment states:
$C + \mathfrak{A} = \{c \in C \mid \surd C + \mathfrak{A} \subseteq c\}$

For illustration, consider the update in Figure 2. The commitment space C has $\surd C$ as its root. The speech act $\mathfrak{A}_\varphi$ updates the commitment space C, leading to the commitment space $C + \mathfrak{A}_\varphi$, which is furthermore updated by $\mathfrak{A}_\psi$, leading to the commitment space $C + \mathfrak{A}_\varphi + \mathfrak{A}_\psi$.

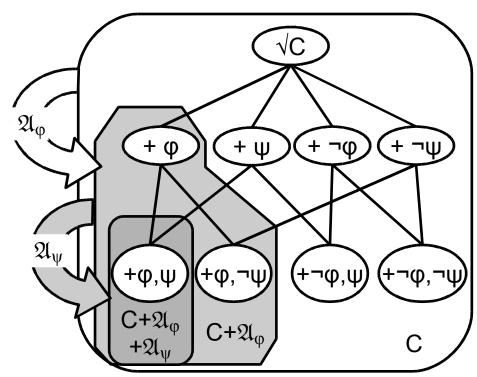

Figure 2: Updates of commitment space

One important application of commitment spaces is **denegations** of speech acts (cf. Cohen & Krifka 2014). It has been acknowledged since Searle (1969) that speech acts can undergo some sort of negation, as in (4):

(4) *I don't promise to come* (≠ *I promise not to come*).

(4) is different from *I promise not to come*. Denegations have been expressed by simply putting a negation sign in front of a logical representation of a speech act (as in Searle & Vanderveken 1985), but as speech acts are not propositions, it is unclear what this should mean. Hare (1970) proposed that they are refusals to make certain speech acts. We can model this with commitment spaces as follows:

(5) Update of a commitment space with the denegation of $\mathfrak{A}$:
$C + {\sim}\mathfrak{A} = C — [C + \mathfrak{A}]$

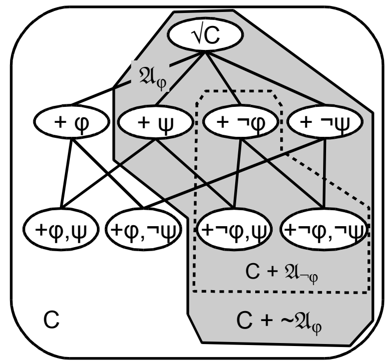

Figure 3:
Update with denegation of φ vs. ¬φ

Figure 3 illustrates the denegation of a speech act introducing the proposition φ, which is distinct from the speech act that introduces the proposition ¬φ. Notice that denegation does not change the root of the commitment space, but prunes its legal developments. Such moves have been called **meta speech act** because they delimits the options for future speech acts (see Cohen & Krifka 2014).

Cohen & Krifka (2014) also introduce the operations of conjunction and disjunction on speech acts, defined as set union and set intersection, respectively:

(6) Speech act conjunction: $C + [\mathfrak{A}\ \&\ \mathfrak{B}] = [C + \mathfrak{A}] \cap [C + \mathfrak{B}]$
$\approx C + \mathfrak{A} + \mathfrak{B}, \approx C + \mathfrak{B} + \mathfrak{A}$

(7) Speech act disjunction: $C + [\mathfrak{A} \vee \mathfrak{B}] = [C + \mathfrak{A}] \cup [C + \mathfrak{B}]$

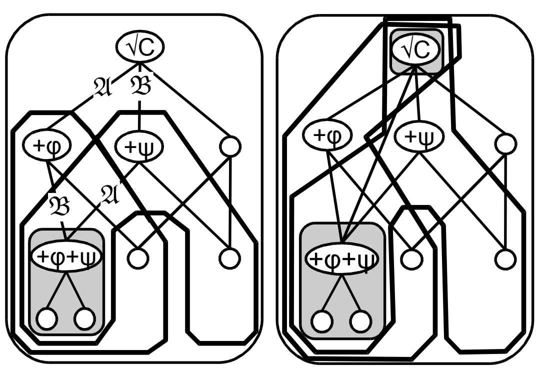

Figure 4:
Conjunction of regular and meta speech acts

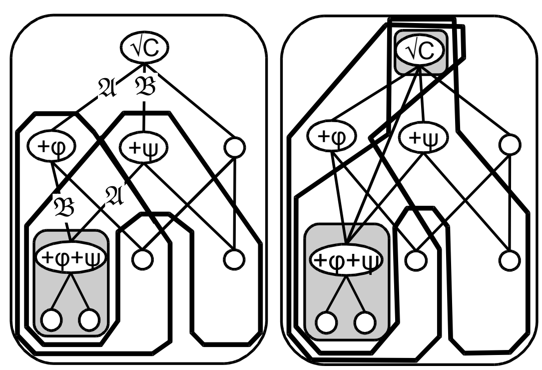

Figure 5:
Disjunction of regular and meta speech acts

Conjunction leads to sets of commitment states that are rooted, that is, to a regular commitment space, cf. Figure 4. In case that there are no anaphoric ties between the speech acts, we get the same result as with sequential update. With disjunctions, only meta speech acts result in commitment spaces that are properly rooted; regular speech acts lead to non-rooted sets of commitment states, cf. Figure 5. Hence disjunction is not defined for speech acts in general. (However, a new root might be created by updating $\surd C$ with the proposition $[\varphi \vee \psi]$ first.)

We have introduced commitment **states** and commitment **spaces**, but we are not quite done yet. There are certain conversational moves that amount to a rejection of a move by the other participant. For this (and perhaps for other ways of referring back to points in conversation) we need a record of the moves in conversation so far. We model this as a sequence of commitment spaces $\langle C_0, C_1, \ldots C_n \rangle$, which we call **Commitment Space Developments (CSD)**. For regular speech acts or meta speech acts, update of commitment space developments is as follows:

(8) Update of a commitment space development with a speech act $\mathfrak{A}$:
$\langle ..., C\rangle + \mathfrak{A} = \langle ..., C, C+\mathfrak{A}\rangle$

CSDs are also a good place to indicate the actor of a speech act, that is, the participant that performed the speech act. I will do this by superscripting the update sign + and the result of the update by the participant.

(9) Update of a commitment space development with speech act $\mathfrak{A}$ by actor S:
$\langle ..., C^{S'}\rangle +^{S} \mathfrak{A} = \langle ..., C^{S'}, [C + \mathfrak{A}]^{S}\rangle$

The **rejection** of of the last speech act is expressed by an operator $\mathfrak{R}$, which returns to the next-to-last commitment state while keeping a record of the rejection process. $\mathfrak{R}$ is defined in (10), where the star * stands for any actor. The last of these commitment stages would correspond the notion of a “Table” in Farkas & Bruce 2010, i.e., the conversational stage under negation.

(10) $\langle ..., C^{*}, C'^{*}\rangle +^{S} \mathfrak{R} = \langle ..., C^{*}, C'^{*}, C^{S}\rangle$

We have used + to indicate the update of commitment states, commitment spaces, and CSDs. Notice that this is shorthand for functional application:

(11) a. $c + \mathfrak{A}_{\varphi} = \mathfrak{A}_{\varphi}(c)$, where $\mathfrak{A}_{\varphi} = \lambda c[c \cup \varphi]$
b. $C + \mathfrak{A} = \mathfrak{A}(C)$, where $\mathfrak{A} = \lambda C\{c \in C \mid \surd C + \mathfrak{A} \subseteq c\}$
c. $\langle ..., C^{*}\rangle +^{S} \mathfrak{A} = \mathfrak{A}^{S}(\langle ..., C^{*}\rangle)$, where $\mathfrak{A}^{S} = \lambda\langle ..., C^{*}\rangle\, \langle ..., C, [\mathfrak{A}(C)]^{S}\rangle$
d. $\langle ..., C\rangle +^{S} \mathfrak{R} = \mathfrak{R}^{S}(\langle ..., [C]_{...}\rangle)$, where $\mathfrak{R}^{S} = \lambda\langle ..., C'^{*}, C^{*}\rangle, \langle ..., C^{*}, C'^{*}, C^{S}\rangle$

It is obvious that the way speech acts are modeled is inspired by modal logic, with the process of update as an accessibility relation. This type of modality could be called **conversational modality**.

2 Assertions and reactions to assertions

We will now consider the speech act that is arguably the most typical for human language, assertion. I follow Brandom (1983) in assuming that with asserting a proposition, the speaker undertakes **responsibility** for what is claimed, by publicly **committing** himself to the truth of that proposition. I express the proposition that a speaker S is committed to the truth of a proposition φ with "$S \vdash \varphi$", honoring the origin of the turnstile $\vdash$ in Frege's "Begriffsschrift" of 1879, where the vertical stroke expresses judgement of the speaker.

It has been claimed that with an assertion of a proposition, a speaker wants to make the addressee believe this proposition (see Bach & Harnish 1979). But this comes about as a secondary effect, otherwise (12a,b) would be contradictions.

(12) a. *Believe it or not, I won the race.*
b. *I don't care whether you believe me, but I won the race.*

Such examples show that the wish to make the other person believe the proposition is cancelable, hence a **conversational implicature** of the assertion. It comes about because the public commitment to the truth of a proposition that is false carries social risks of losing honor, or face, something that the speaker wants to avoid; this constitutes a reason for the addressee to believe the proposition.

It has also been claimed that in an assertion, the speaker expresses that the speaker believes the asserted proposition, which then constitutes a reason for the hearer to believe the proposition (see Lauer 2013). This would explain Moore's paradox, the pragmatic infelicity of assertions like #*It is raining but I don't believe it.* But again, this is just a side effect. If asserting a proposition φ were the same as expressing that S_1 believes φ, then (13a) and (b) would mean the same.

(13) a. *Ed won the race.*
b. *I believe that Ed won the race.*

In fact, (13b) is not a commitment to the proposition that Ed won the race, but a commitment to the proposition of having a belief that Ed won the race. This can be used to make the addressee accept the proposition that Ed won the race if the addressee considers the speaker a reasonable person.

Under the assumption that assertions express public commitments, the assertion of a proposition φ by a speaker S_1 should have the following effect:

(14)
$$\begin{aligned} \langle ..., C^* \rangle +^{S_1} S_1 \vdash \varphi &= \langle ..., C^*, [C + S_1 \vdash \varphi]^{S_1} \rangle \\ &= \langle ..., C^*, \{c \subseteq C \mid \sqrt{C} + S_1 \vdash \varphi \subseteq c\}^{S_1} \rangle \end{aligned}$$

How are assertions formally expressed? I assume that the commitment $S_1 \vdash \varphi$ itself is expressed in its own phrasal category, which I will call **Commitment phrase** (**CmP**). I will use the sign $\vdash$ for the head of an assertive CmP. In addition, I assume the existence of a speech act phrase, or **Act phrase** (**ActP**). This is reminiscent of the speech act phrase (SAP) of Speas 2004, but its role is different, as it will distinguish between assertions and questions, which are both related to commitments. For assertions, the head of the ActP will be rendered by ".". In speech, this is expressed by falling prosody of the intonational phrase that corresponds to the speech act (see Truckenbrodt 2015). (15) illustrates the basic structure.

(15) $[_{\text{ActP}} [[_{\text{Act}^\circ} \,.\,]\ [_{\text{CmP}} [[_{\text{Cm}^\circ} \vdash]\ [_{\text{TP}}\ \textit{I won the race}]]]]]$

(16) $[_{\text{ActP}}\ \textit{I}\ [[_{\text{Act}^\circ} \,.\ \textit{won}]\ [_{\text{CmP}} [t_I\ [_{\text{Cm}^\circ} \vdash t_{won}]\ [_{\text{TP}}\ t_I\ t_{won}\ \textit{the race}]]]]]$

We can assume that the finite verb undergoes head movement, and that the subject moves via the specifiers to occupy the SpecActP, as illustrated in (16) (see Truckenbrodt 2006). For interpretation purposes, I will assume that these movements are reconstructed, and work with the structure in (15). Interpretation is with respect to a function $[\![...]\!]^{S_1S_2}$ that specifies the speaker S_1 and the addressee S_2. I assume that the TP denotes a proposition, with *I* referring to the speaker.

(17) $[\![[_{\text{ActP}} [[_{\text{Act}^\circ} \,.\,]\ [_{\text{CmP}} [[_{\text{Cm}^\circ} \vdash]\ [_{\text{TP}}\ \textit{I won the race}]]]]]]\!]^{S_1S_2}$
$= [\![[_{\text{Act}^\circ} \,.\,]]\!]^{S_1S_2}([\![[[_{\text{Cm}^\circ} \vdash]\ [_{\text{TP}}\ \textit{I won the race}]]]\!]^{S_1S_2})$
$= [\![[_{\text{Act}^\circ} \,.\,]]\!]^{S_1S_2}([\![[_{\text{Cm}^\circ} \vdash]]\!]^{S_1S_2}([\![[_{\text{TP}}\ \textit{I won the race}]]\!]^{S_1S_2}))$

with $[\![[_{\text{TP}}\ \textit{I won the race}]]\!]^{S_1S_2} =$ 'S_1 won the race'
$[\![[_{\text{Cm}^\circ} \vdash]]\!]^{S_1S_2} = \lambda p \lambda S[S \vdash p]$
$[\![[_{\text{Act}^\circ} \,.\,]]\!]^{S_1S_2} = \lambda R \lambda \langle ..., C^* \rangle [\langle ..., C^*, [C + R(S_1)]^{S_1} \rangle]$
$= \lambda \langle ..., C^* \rangle\ [\langle ..., C^*, [C + S_1 \vdash \text{'}S_1 \text{ won the race'}]^{S_1} \rangle]$

This is a function that updates the last CS of a CSD, as illustrated in (18).

(18) $(17)(\langle ..., C^* \rangle) = \langle ..., C^*, [C + S_1 \vdash \text{'}S_1 \text{ won the race'}]^{S_1} \rangle$
$= \langle ..., C^* \rangle +^{S_1} S_1 \vdash \varphi$, for short.

Notice that $[_{\text{Cm}^\circ} \vdash]$ is interpreted as function $\lambda p \lambda S[S \vdash p]$, which does not specify the committing participant S yet. This is achieved by $[_{\text{Act}^\circ} \,.\,]$, which involves application of R to the speaker S_1, and marking the last move as one of the speaker S_1. Thus CmP and the ActP have different functions; while CmP with its head $\vdash$ identifies the nature of the speech act, the ActP with identifies the nature of the update by identifying the actor and passing it on to the CmP.

I have argued in Section 2 that by adding the commitment $S_1 \vdash \varphi$, speaker S_1 typically intends to make S_2 accept the proposition φ itself. I will model this by assuming that (14) gives rise to a second update, this time of φ itself. This update is cancelable, cf. (12), hence it has the status of a conversational implicature. The full effect of a standard assertion then is as in (19) and in Figure 6.

(19) $\langle ..., C^{*}\rangle +^{S_1} S_1 \vdash \varphi \; +^{S_1} \varphi$
$= \langle ..., C^{*}, [C + S_1\vdash\varphi]^{S_1}, [C + S_1\vdash\varphi + \varphi]^{S_1}\rangle$

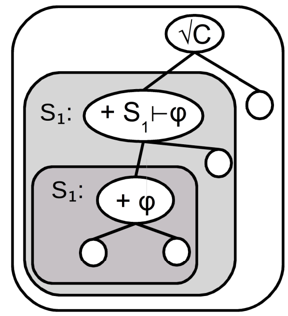

Figure 6:
Assertion of φ, followed by conventional implicature φ

Let us now consider typical **reactions** to assertions. Speaker S_2 can simply **acknowledge** the assertion by S_1 with utterances like *Okay, Mmh,* or nodding. In this, S_2 confirms the last move of S_1. Another kind of reaction is by response particles like *yes* and *no*. As argued in Krifka 2013, such particles are sentential anaphors that pick up recently introduced propositions, where *yes* asserts the sentential anaphor, and *no* asserts its negation. The propositional discourse referent is introduced by the TP of the antecedent clause.

(20) S_1: $[_{\text{ActP}}\ [[.]\ [_{\text{CmP}}\ [[\vdash]\ [_{\text{TP}}$ *I won the race*$]]]]]$ ↪ φ — introduction of propositional discourse referent φ
S_2: *Yes.* $+_{S_2}\ S_2\vdash\varphi$ — assert φ
S_2: *No.* $+_{S_2}\ S_2\vdash\neg\varphi$ — assert negation of φ

(21) illustrates confirmation by *yes.* Contradiction by *no* as in (22) requires a retraction $\mathfrak{R}$, because otherwise the resulting commitment state would contain both φ and $S_2\vdash\neg\varphi$, which is incoherent.

(21) (19) + S_2: *Yes*. = (19) $+^{S_2} S_2\vdash\varphi$
$= \langle ..., C^{*}, [C + S_1\vdash\varphi]^{S_1}, [C + S_1\vdash\varphi + \varphi]^{S_1}, [C + S_1\vdash\varphi + \varphi \mathbf{+ S_2\vdash\varphi]^{S_2}}\rangle$

(22) (19) + S_2: *No*. = (19) $+^{S_2} \mathfrak{R} +^{S_2} S_2\vdash\neg\varphi$
$= \langle ..., C^{*}, [C + S_1\vdash\varphi]^{S_1}, [C + S_1\vdash\varphi + \varphi]^{S_2}, \mathbf{[C + S_1\vdash\varphi]^{S_2}}, [C + S_1\vdash\varphi + \mathbf{S_2\vdash\neg\varphi}]^{S_2}\rangle$

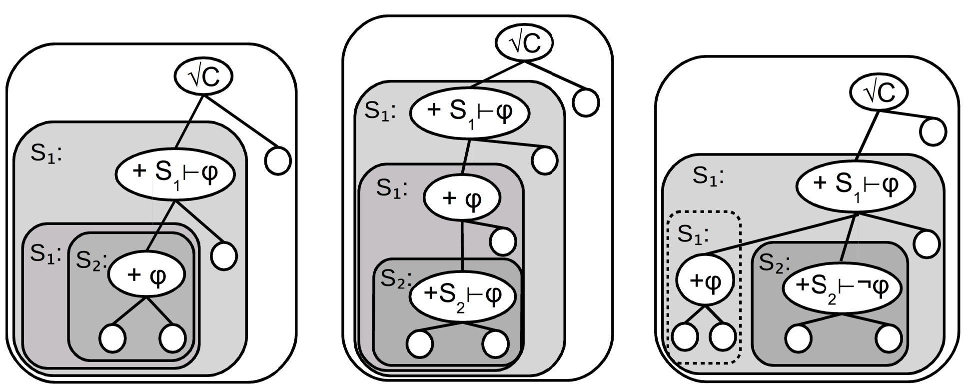

Figure 7:
Acknowledgement (*okay*), Confirmation (*yes*) and Contradiction (*no*) of an assertion

The resulting commitment space contains the information that S_1 is committed to φ, and that S_2 is committed to $\neg\varphi$. Hence, S_1 and S_2 contradict each other. Acknowledgement, confirmation and contradiction are illustrated in Figure 7. Retraction $\mathfrak{R}$ is enacted when necessary; it is not a feature of the response particle *no* itself. If the antecedent clause contains a negation, as in *I didn't win the race*, an answer like *No, you didn't* does not involve a retraction (see Krifka 2013).

3 Polar questions and reactions to polar questions

The current framework creates the possibility of analyzing questions as a derivative of other speech acts, in particular, assertions. With an information question, a speaker requests an assertion of a particular type from the other speaker. This can be modeled by a meta speech act that does not change the root of the commitment space, but restricts the possible continuations – to those in which the other speaker makes an assertion of an appropriate type.

A yes/no question, or polar question, is classically analyzed as offering a choice between two alternatives, a proposition and its negation (cf. Hamblin 1973). This can be expressed in the current framework as in (23) and Figure 8.

(23) $\langle ..., C^{*}\rangle + S_1$ to S_2: *Did I win the race?*
$= \langle ..., C^{*}, [\{\surd C\} \cup C + S_2{\vdash}\varphi \cup C + S_2{\vdash}\neg\varphi]^{S_1}\rangle$

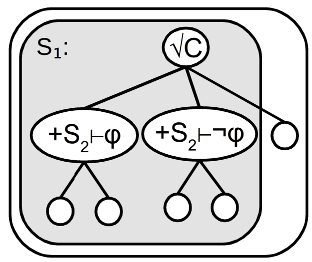

Figure 8: Bipolar question

In this move, S_1 restricts the future development of C in such a way that the only legal continuations are the commitments by S_2 that S_1 won the race, or that S_1 did not win the race, or moves that are entailed by these commitments. These commitments can be expressed by *yes* and *no*, respectively, which pick up the propositional discourse referent introduced by the question.

(24) a. (23) + S_2: *Yes*. = (23) $+^{S_2}$ $S_2{\vdash}\varphi$ b. (23) + S_2: *No*. = (23) $+^{S_2}$ $S_2{\vdash}\neg\varphi$

Non-congruent answers like *I don't know* can be expressed after a prior retraction of the last move. Retraction is required because the resulting commitment space could not contain both the information $S_2{\vdash}\varphi$ and $S_2{\vdash}$'S_2 does not know whether φ', or $S_2{\vdash}$'S_2 does not want to tell whether φ'.

(25) (23) $+^{S_2}\,\mathfrak{R}\,+^{S_2}$ S_2: *I don't know.* = $\langle ..., C^{*}, [\{\surd C\} \cup C + S_2{\vdash}\varphi \cup C \cup S_2{\vdash}\neg\varphi]_{S_1}$,
$C_{S_2}, [C + S_2{\vdash}$'$\neg S_2$ knows whether φ'$]_{S_2}\rangle$

Figure 9 and Figure 10 illustrate congruent answers by *yes* and *no*, which do not require retraction, and a refusal to answer, which does. This corresponds to the standard treatment of polar questions as presenting an option between two alternatives; I will call such questions **bipolar**. But questions may be skewed towards

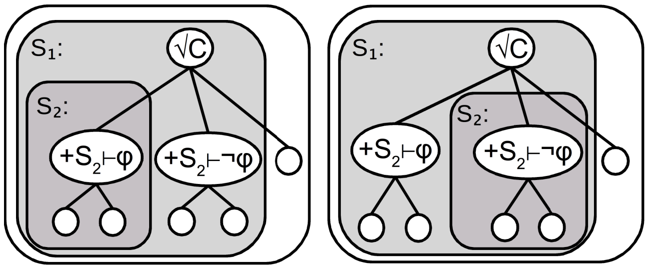

Figure 9:
Answers *yes* and *no* to bipolar question

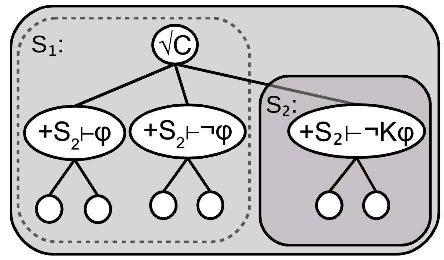

Figure 10:
Rejection of bipolar question

one answer, so-called **biased** questions. One example are declarative questions with assertive syntax, but rising prosody (Gunlogson 2002).

(26) *I won the race?*

Standard question theories have problems with biased questions; they have to resort to extraneous means to highlight one option over others (see e.g., Inquisitive Semantics; Farkas & Roelofson 2015). In the current framework there is a natural way to represent question bias: A speaker can propose just one legal continuation to the addressee. I will call such moves **monopolar** questions.

(27) $\langle ..., C^{*}\rangle + S_1$, to S_2: *I won the race?*
$= \langle ..., C^{*}, [\{\surd C\} \cup C + S_2 \vdash \varphi]^{S_1}\rangle$

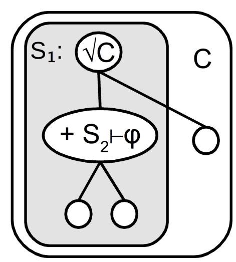

Figure 11: Monopolar (biased) question

Notice that the answer *yes* is straightforward, whereas the answer *no* requires a prior rejection. This reflects the bias of such questions towards one particular answer.

(28) a. (27) + S_2: *Yes*. = (27) $+^{S_2} S_2 \vdash \varphi$

b. (27) + S_2: *No.* = (27) $+^{S_2} \mathfrak{R} +^{S_2} S_2$: *No.*
$= \langle ..., C^{*}, [\{\surd C\} \cup C + S_2 \vdash \varphi]^{S_1}, C^{*}, [C + S_2 \vdash \varphi]^{S_2}\rangle$

There is evidence that standard English polarity questions like *Did I win the race?* have a biased reading as well. This is evident with questions that contain a propositional negation. In standard analyses, such questions have the same reading as their non-negated counterparts. However, this is contrary to fact; they are biased towards their (negated) proposition.

(29) $\langle ..., C_{...}\rangle + S_1$, to S_2: *Did I not win the race?*
$= \langle ..., C^*, [\{\surd C\} \cup C + S_2 \vdash \neg\varphi]^{S_1}\rangle$

How are question meanings constructed? We assume that they are based on an Act phrase head $[_{Act^o}$?] that requests the commitment denoted by the complement of the ActP to be performed by the addressee. (30) gives a full derivation. We assume that the specifier position of the ? act phrase remains empty, and that auxiliaries undergo head movement to $[_{Act^o}$?]. Notice that the ? head identifies the committer as S_2, the addressee; the actor of the speech act itself remains S_1.

(30) $[\![[_{ActP} [[_{Act^o}\ ?\ \textit{Did}\ ]\ [_{CmP} [[_{Cm^o} \vdash t_{did}\ ]\ [_{TP}\ \textit{I}\ t_{did}\ \textit{win the race}]]]]]]\!]^{S_1S_2}$
$= [\![[_{Act^o}\ ?\ ]]\!]^{S_1S_2}([\![[[_{Cm^o} \vdash]\ [_{TP}\ \textit{I did win the race}]]]\!]^{S_1S_2})$
$= [\![[_{Act^o}\ ?\ ]]\!]^{S_1S_2}([\![[_{Cm^o} \vdash]]\!]^{S_1S_2}([\![[_{TP}\ \textit{I did win the race}]]\!]^{S_1S_2}))$

with $[\![[_{TP}\ \textit{I won the race}]]\!]^{S_1S_2} =$ 'S_1 won the race'
$[\![[_{Cm^o} \vdash]]\!]^{S_1S_2} = \lambda p \lambda S[S \vdash p]$
$[\![[_{Act^o}\ ?\ ]]\!]^{S_1S_2} = \lambda R \lambda\langle ..., C^*\rangle[\langle ..., C^*, [\{\surd C\} \cup C + R(\mathbf{S_2})]^{S_1}\rangle]$ $(S_2!)$
$= \lambda\langle ..., C^*\rangle\ [\langle ..., C^*, [\{\surd C\} \cup C + S_2 \vdash$ 'S_1 won the race'$]^{S_1}\rangle]$

This results in the monopolar question interpretation of standard polar questions with a compositional meaning. For declarative questions as in (26) we can assume a syntactic structure in which the ? interpretation of the ActP is triggered by rising prosody of the intonational phrase that corresponds to the speech act.

What about the derivation of the **bipolar interpretation**? I assume that it comes about as a result of a **disjunction** of monopolar questions. Disjunction of CSDs $\langle ..., C^S\rangle \vee \langle ..., C'^S\rangle$ amounts to the set union of the final commitment space, $\langle ..., C^S \cup C'^S\rangle$, and disjunction of two functions on CSDs $\lambda\langle ...\rangle[\langle ..., C^S\rangle] \vee \lambda\langle ...\rangle[\langle ..., C'^S\rangle]$ amounts to the disjunction of their arguments, $\lambda\langle ...\rangle[\langle ..., C^S\rangle \vee \langle ..., C'^S\rangle]$.

The role of disjunction is obvious with alternative questions as in (31). It results in a bipolar question, as illustrated in Figure 12. Notice that the existence of alternative questions like (31) is another piece of evidence that a canonical polarity question like *Did I win the race?* has a monopolar reading; otherwise such disjunctions would be redundant.

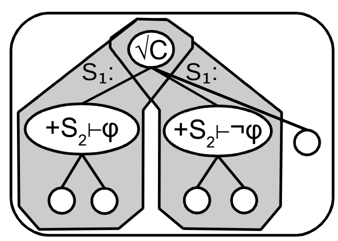

Figure 12:
Disjunction of monopolar questions

(31) S_1 to S_2: *Did I win the race, or not?*
$= [\![[_{ActP}\ \textit{Did I win the race}]]\!]^{S_1S_2} \vee [\![[_{ActP}\ \textit{did I not win the race}]]\!]^{S_1S_2}$
$= \lambda\langle ..., C^*\rangle[\langle ..., C^*, [\{\surd C\} \cup C + S_2 \vdash$ 'S_1 won the race'$]$
$\cup [\{\surd C\} \cup C + S_2 \vdash \neg$'$S_1$ won the race'$]^{S_1}\rangle]$

This strategy of forming bipolar question is evident in Chinese A-not-A questions, in contrast to questions marked by the final particle *ma*, which have a biased, i.e., monopolar reading (see Li & Thompson 1981). For example, whereas

(32a) can be used as a neutral information question, it is inappropriate in a context in which the speaker sees the addressee eating an apple.

(32) a. *Nī chí bu chí píngguo?*
you eat not eat apple
'Do you eat apples?'

b. *Nǐ chí píngguo ma?*
you eat apple QU
'Do you eat apples?', 'You eat apples?'

But how does a canonical polarity question in English receive a bipolar reading that results in a non-biased question? Let us first consider the analysis of alternative questions like (33a) and constituent questions like (33b).

(33) a. *Did Ed meet Ann, Beth, or Carla?*
b. *Who did Ed meet?*

The alternative question (33a) can be analyzed by assuming that the alternative phrase $[_{\text{DP}}$ *Ann, Beth, or Carla*$]$ scopes out to SpecActP on the level of logical form, where it is interpreted as a disjunction over speech acts.

(34)
$$
\begin{aligned}
&[\![[_{\text{ActP}}\ [_{\text{DP}}\ \textit{Ann, Beth, or Carla}]_i \\
&\qquad [_{\text{Act}'}\ [_{\text{Act}^\circ}\ ?\text{-}\textit{did}]\ [_{\text{CmP}}\ [[_{\text{Cm}^\circ}\ \vdash]\ [_{\text{TP}}\ \textit{Ed}\ \text{t}_{\textit{did}}\ \textit{meet}\ \text{t}_i]]]]]]]^{S_1S_2} \\
&= [\![[_{\text{DP}}\ \textit{Ann, Beth, or Carla}]]\!]^{S_1S_2} \\
&\qquad (\lambda x_i\ [\![[_{\text{Act}'}\ [_{\text{Act}^\circ}\ ?\text{-}\textit{did}]\ [_{\text{CmP}}\ [[_{\text{Cm}^\circ}\ \vdash]\ [_{\text{TP}}\ \textit{Ed}\ \text{t}_{\textit{did}}\ \textit{meet}\ \text{t}_i]]]]]]^{S_1S_2,t_i/x_i}) \\
&\text{with}\ [\![[_{\text{DP}}\ \textit{Ann, Beth, or Carla}]]\!]^{S_1S_2} \\
&\qquad = \lambda R[R(\text{Ann}) \lor R(\text{Beth}) \lor R(\text{Carla})] \\
&\text{and}\ \ \lambda x_i[\![[_{\text{Act}'}\ [_{\text{Act}^\circ}\ ?\text{-}\textit{did}]\ [_{\text{CmP}}\ [[_{\text{Cm}^\circ}\ \vdash]\ [_{\text{TP}}\ \textit{Ed}\ \text{t}_{\textit{did}}\ \textit{meet}\ \text{t}_i]]]]]]^{S_1S_2,t_i/x_i} \\
&\qquad = \lambda x_i\ \lambda\langle \ldots, C^*\rangle[\langle \ldots, C^*, [\{\surd C\} \cup C + S_2 \vdash \text{'Ed met } x_i\text{'}]^{S_1}\rangle \\
&= \lambda\langle \ldots, C^*\rangle[\langle \ldots, C^*, [\langle \ldots, C^*, [\{\surd C\} \cup C + S_2 \vdash \text{'Ed met Ann'} \\
&\qquad\qquad\qquad\qquad\qquad\qquad\qquad \cup C + S_2 \vdash \text{'Ed met Beth'} \\
&\qquad\qquad\qquad\qquad\qquad\qquad\qquad \cup C + S_2 \vdash \text{'Ed met Carla'}]^{S_1}\rangle]
\end{aligned}
$$

Taking φ_a, φ_b and φ_c as abbreviations for the respective propositions, this results in the commitment space illustrated in Figure 13. The developments are restricted to one of the three assertions by S_2, that Ed met Ann, that Ed met Beth, or that Ed met Carla.

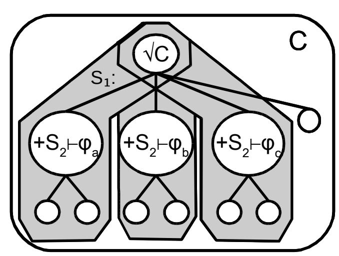

Figure 13: Alternative question

Constituent questions like (33b) work in a similar way, with the exception that in languages that show wh-movement like English SpecActP is filled explicitly, with the wh expression.

(35) $[\![[_{\text{ActP}}\ [_{\text{DP}}\ \textit{which woman}]_i$
$[_{\text{Act'}}\ [_{\text{Act°}}\ ?\text{-}\textit{did}]\ [_{\text{CmP}}\ [[_{\text{Cm°}} \vdash]\ [_{\text{TP}}\ \textit{Ed}\ t_{\textit{did}}\ \textit{meet}\ t_i]]]]]]\!]^{S_1S_2}$
$= [\![[_{\text{DP}}\ \textit{which woman}]]\!]^{S_1S_2}$
$(\lambda x_i\ [\![[_{\text{Act'}}\ [_{\text{Act°}}\ ?\text{-}\textit{did}]\ [_{\text{CmP}}\ [[_{\text{Cm°}} \vdash]\ [_{\text{TP}}\ \textit{Ed}\ t_{\textit{did}}\ \textit{meet}\ t_i]]]]]\!]^{S_1S_2,t_i/x_i})$
with $[\![[_{\text{DP}}\ \textit{which woman}]]\!]^{S_1S_2} = \lambda R \bigvee_{x \in [\![\textit{woman}]\!]} [R(x)]$
$= \lambda\langle ..., C^*\rangle[\langle ..., C^*, [\langle ..., C^*, [\{\surd C\} \cup \cap\{C + S_2 \vdash \text{'Ed met } x_i\text{'} \mid x_i \in \text{Woman}\}]^{S_1}\rangle]$

Alternative questions and constituent questions have been interpreted as involving a disjunction over an abstraction of a monopolar question speech act, resulting in a speech act disjunction. I suggest that this is also the mechanism by which a polar question, with basic monopolar interpretation, gets its **bipolar** reading. This is mediated by a **polarity phrase,** PolP, which is involved in cases of negation and of verum focus. I assume a trace T in the polarity phrase that can either be specified by the verum operator, λp[p], or the falsum operator, λp[¬p]. I also assume that this structure is interpreted disjunctively – as with alternative and wh-questions – by a phonologically empty operator D, cf. (36).

(36) $[_{\text{ActP}}\ D\ \lambda T[_{\text{Act'}}[_{\text{Act°}}\ ?\ ][_{\text{CmP}}\ [[\vdash]\ [_{\text{PolP}}\ [[_{\text{Pol°}}\ T\text{-}\textit{did}]\ [_{\text{TP}}\ \textit{I}\ t_{\text{did}}\ \textit{win the race}]]]]]]]$

Under the assumptions in (37) we get the right result, a bipolar reading. When applied to a CSD with final commitment space C, this will yield the commitment space illustrated in Figure 12 above.

(37) With $[\![D]\!]^{S_1S_2} = \lambda R[R(\lambda p[p]) \vee R(\lambda p[\neg p])]$
and $[\![\lambda T[_{\text{Act'}}[_{\text{Act°}}\ ?\ ][_{\text{CmP}}\ [[\vdash]\ [_{\text{PolP}}\ [[_{\text{Pol°}}\ T\text{-}\textit{did}]\ [_{\text{TP}}\ \textit{I}\ t_{\text{did}}\ \textit{win the race}]]]]]]]\!]^{S_1S_2}$
$= \lambda T\lambda\langle ..., C^*\rangle[\langle ..., C^*, [\{\surd C\} \cup C + S_2 \vdash T(\text{'}S_1 \text{ won the race})]^{S_1}\rangle]$
$[\![(36)]\!]^{S_1S_2} = \lambda\langle ..., C^*\rangle[\langle ..., C^*, [\{\surd C\} \cup C + S_2 \vdash \text{'}S_1 \text{ won the race'}$
$\cup\ C + S_2 \vdash \neg\text{'}S_1 \text{ won the race'}]^{S_2}\rangle]$

In this section I have proposed a new notion, monopolar questions, which propose one continuation by an assertion of the addressee. This can be used to model biased questions without any additional device that identifies one alternative over other alternatives. Monopolar questions allow for a straightforward analysis of alternative questions and of constituent questions as involving speech act disjunctions. Bipolar questions can be derived as explicit question disjunction.

4 Negated questions

We have seen in (29) that a question with a propositional negation in a TP should be interpreted as a monopolar question. It is well-known that there is another type of negation in questions, so-called high negation (see Ladd 1981; Romero 2005; Repp 2012), as illustrated in (38)

(38) *Didn't I win the race?*

There are a number of analyses of such questions, in particular by Romero & Han (2002) and Romero (2005), who propose an interaction with the VERUM operator, Repp 2013, who proposes an interaction with the FALSUM operator, and Krifka (to appear), who proposes that they express speech act denegation. These theories can account for the high syntactic position of negation in such cases. There are others, such as Asher & Reese 2007, who assume that speech acts like (38) express a combination of a question and an assertion, that apparently cannot account for this fact about syntax/semantics mapping.

I propose that questions such as (38) express a negation on the level of the **commitment phrase**; this explains the high syntactic position of negation.

(39) $[\![[_{\text{ActP}} [[_{\text{Act}^\circ}\ ?\ \textit{Did}]\ [_{\text{CmP}}\ \textit{n't}\ [[_{\text{Cm}^\circ} \vdash]\ [_{\text{TP}}\ \textit{I}\ \text{t}_{\text{did}}\ \textit{win the race}]]]]]\!]^{S_1S_2}$
$= [\![[_{\text{Act}^\circ}\ ?]]\!]^{S_1S_2}([\![\textit{not}]\!]^{S_1S_2}([\![\vdash]\!]^{S_1S_2}([\![[_{\text{TP}}\ \textit{I did win the race}]]\!]^{S_1S_2})))$
$= \lambda\langle ..., C^*\rangle[\langle ..., C^*, [\{\surd C\} \cup C + \neg S_2{\vdash}\varphi]^{S_1}\rangle]$

With this move, S_1 asks S_2 to express non-commitment towards the proposition φ, as illustrated in Figure 14. Notice that adding $\neg S_2{\vdash}\varphi$ to the commitment space precludes commitment to φ, i.e., $S_2{\vdash}\varphi$, but is compatible with commitment to ¬φ, i.e., $S_2{\vdash}\neg\varphi$. Hence, $\neg S_2{\vdash}\varphi$ is pragmatically weaker than $S_2{\vdash}\neg\varphi$. The former proposition, $\neg S_2{\vdash}\varphi$, does not force S_2 to also commit to ¬φ, whereas the proposition $S_2{\vdash}\neg\varphi$ forces S_2 not to commit to φ, as it would be incompatible with $S_2{\vdash}\varphi$. The TP in (39) introduces a propositional discourse referent φ that can be picked up by *no,* which asserts its negation, ¬φ. The answer *yes* requires a rejection of the last move in (39). The reaction *I don't know* does not require a rejection, as it is compatible with S_2 being not committed to φ.

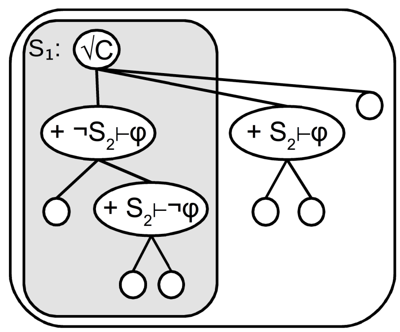

Figure 14: High negation question

This relation of strength captures the usage conditions of questions with high negation, in contrast to questions with low, propositional negation and questions without any negation. These conditions have been discussed in Büring & Gunlogson 2000 in relation to the contextual evidence. Consider the situations in (40).

(40) a. S_1 looks at the yellow pages of a small town, finds a restaurant "V-Day"
b. S_1 has no information but considers eating in a vegetarian restaurant.
c. S_1 looks at the yellow pages of a small town, only finds restaurants like "Meateater's delight", "The Big T-Bone", etc.

In (40a) there is contextual evidence that there is a vegetarian restaurant, (b) is rather neutral but expresses an interest in the truth of the proposition that there is a vegetarian restaurant, and in (c) there is evidence that there is no such restaurant. Now consider the three questions with no, low, and high negation.

(41) i. S_1: *Is there a vegetarian restaurant around here?*
ii. S_1: *Is there no vegetarian restaurant around here?*
iii. S_1: *Isn't there a vegetarian restaurant around here?*

The following table specifies the combination of contexts and acceptable uses.

Contextual evidence	(i) no neg.	(ii) low neg.	(iii) high neg.
(a) There is a vegetarian restaurant	ok (mono)	#	#
(b) neutral	ok (bi)	#	ok
(c) There is no vegetarian restaurant	(#)	ok	ok

Table 1

Büring & Gunlogson 2000 assume that questions with no negation (i) either have a bias towards the proposition (a), or have no bias (b). In the current theory, this can be explained by the ambiguity of such questions between a monopolar reading, which is appropriate in setting (a) because there is evidence for the proposed assertion, and a bipolar reading, which is appropriate in setting (b) because both assertions can be made with roughly the same a-priori likelihood. The question with no negation is somewhat inappropriate in setting (c): The monopolar reading is bad because it identifies a proposition for which there is no contextual evidence, and the bipolar reading suggests that either assertion is about equally likely. – The question with low negation (ii) only has a monopolar reading, as the bipolar interpretation is blocked by the corresponding question without negation. As it expresses a bias towards the negated proposition, it is acceptable only in setting (c). – The question with high negation (iii) is weaker than (ii). It is clearly impossible in setting (a): As there is evidence for φ, there is no reason to check whether the addressee would not commit to φ. In setting (c), the question is appropriate; in contrast to the question with low negation, it allows answers like *I don't know* without prior rejection. Büring & Gunlogson assume that the question with high negation is fine in setting (b) as well, but notice that context (b) is not completely neutral: There is some interest in eating out in a vegetarian restaurant. Posing the high-negation question allows more easily for a non-committing answer in this case.

5 Question tags

We finally consider question tags as conversational moves that affect the nature of assertion. According to Cattell 1973, question tags come in two varieties. A so-call **matching** question tag as in (42) indicates that the assertion is put forward as a potential view of the listener. With a **reverse** question tag as in (43), which has the opposite polarity of the host clause, the speaker offers his or her own opinion, and asks for agreement by the addressee.

(42) *You are tired, are you?*

(43) a. *I have won the race, haven't I?* b. *I haven't won the race, have I?*

Matching question tags can be analyzed as speech act **conjunction** of an assertion and a monopolar question, as illustrated in (44) and in Figure 15.

(44) *I have won the race, have I?*

$C +_{S_1} [[\![[_{\text{ActP}}\ [\ .\ ]\ [_{\text{CmP}}[\vdash]\ [_{\text{TP}}\ \textit{I have won the race}]]]]\!]^{S_1S_2}\ \&$

$[\![[_{\text{ActP}}\ [\ ?\ ]\ [_{\text{CmP}}[\vdash]\ [_{\text{TP}}\ \textit{I have won the race}]]]]\!]^{S_1S_2}]$

$= [C + S_1\vdash\varphi] \cap [\{\surd C\} \cup C + S_2\vdash\varphi]$

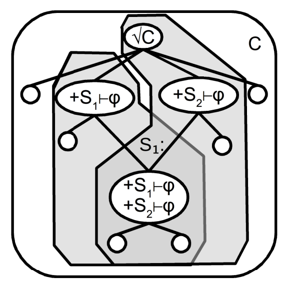

Figure 15:
Matching question tag

Notice that this is not a move in which the speaker first makes an assertion and then asks the addressee to make the same assertion. Rather, the two speech acts are first conjoined, and then applied as one complex speech act to the commitment space C. This corresponds to the fact that assertions with question tags are realized in one intonational phrase. The overall effect is that S_1 proposes to S_2 that both S_1 and S_2 are committed to the proposition φ. That is, S_1 proposes dark central area in Figure 15 as new commitment space. S_1 can propose $S_2\vdash\varphi$ because φ is understood as a commitment that S_2 has already anyway; this captures Cattell's characterization of matching question tags as voicing a likely opinion of the addressee. If S_2 does not react, then the proposed commitments obtain. S_2 can react with *yes*, a move that is actually redundant given the root of the new commitment space of (44). If S_2 reacts with *no* and thus asserts ¬φ, this requires a previous reject operation, which will also reject that S_1 is committed to φ. In this feature, an assertion with a matching tag differs from a simple assertion; if rejected by the addressee, the speaker is still committed to the truth of the proposition. Again, this corresponds to Cattell's characterization of matching question tags.

We now turn to reverse question tags, which I will analyze by speech act **disjunction**. (45) and Figure 16 illustrate the analysis for the example with positive host clause and negated tag. I interpret the negation the question tag as low negation; an analysis in terms of high negation is possible as well.

(45) *I have won the race, haven't I?*

$\mathrm{C} +_{\mathrm{S_1}} [[\![[_{\mathrm{ActP}}\ [\ .\ ]\ [_{\mathrm{CmP}}\ [\vdash]\ [_{\mathrm{TP}}\ \textit{I have won the race}]]]]\!]^{\mathrm{S_1S_2}} \vee$
$[\![[_{\mathrm{ActP}}\ [\ ?\ \textit{have'nt}\ ]\ [_{\mathrm{CmP}}\ [\vdash\ ]\ [_{\mathrm{TP}}\ [[\mathrm{t}_{n't}]\ [_{\mathrm{TP}}\ \textit{I}\ t_{have}\ \textit{won the race}]]]]]]\!]^{\mathrm{S_1S_2}}]$
$= [\mathrm{C} + \mathrm{S_1}\vdash\varphi] \cup [\{\surd\mathrm{C}\} \cup \mathrm{C} + \mathrm{S_2}\vdash\neg\varphi]$

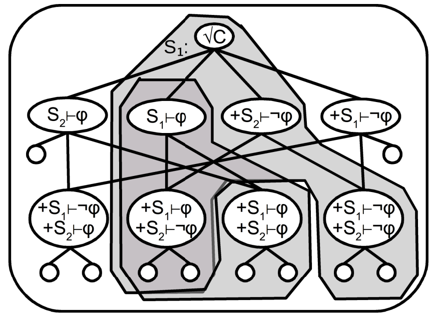

Figure 16: Reverse question tag

The resulting commitment space is the whole gray area in Figure 16. Notice that it excludes that $\mathrm{S_2}$ is committed to φ but $\mathrm{S_1}$ is committed to $\neg\varphi$. This means that if $\mathrm{S_2}$ commits to φ, then $\mathrm{S_1}$ is committed to φ as well. This corresponds to the use of such conversational moves, where $\mathrm{S_1}$ puts forward a commitment to φ, asking $\mathrm{S_2}$ for support. If $\mathrm{S_2}$ does not provide this support by committing to $\neg\varphi$, $\mathrm{S_1}$ is free to either stick with the commitment to φ, or to retract it and even assert $\neg\varphi$, without contradicting an earlier commitment. This corresponds Cattell's characterization of reverse question tags. Also, the disjunction as basic operation is evident in languages that use overt disjunction in question tags, as in German, see (46)

(46) *Ich hab das Rennen gewonnen, oder?*
I have the race won, or
'I won the race, didn't I?'

6 Conclusion

This article developed a theory of conversational update by speech acts that does not only model the current common ground (called commitment state), but also its projected continuation (the commitment space). This leads to a new conception of questions as conversational moves in which the speaker suggests particular assertions by the addressee. This view allows for "monopolar" questions that offer just one option for continuation. I argued that this is the proper analysis of biased questions, and proposed new analyses of alternative questions and constituent questions as disjoined monopolar questions. I have analyzed high-negation questions as projected non-commitments by the addressee, and of matching / reverse question tags as conjunctions / disjunctions of an assertion and a question.

I would like to highlight one promising aspect of the framework developed here: It distinguishes between the actor or instigator of a speech act and the committer of a proposition. In regular assertions, these roles are both assumed by the speaker; in a question, the speaker is the instigator, and the addressee the committer, of the projected commitment. This provides a new handle on **conjunct-disjunct** systems in languages like Newari, where the conjunct form appears to index the committer, the speaker in assertions, and the addressee in questions. Furthermore, it provides a new way of dealing with assertions like *Mary says it will rain tomorrow*, which appear to add the embedded proposition to he common ground, rather than the proposition that Mary believes it. We can see this as an act in which the speaker adds a commitment "on behalf" of Mary, who is the committer, a **proxy speech act** in the sense of Krifka (2014).

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