Focus and Contrastive Topics in Question Acts

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1. Introduction

It is well-known that in many languages, the focus in the answer corresponds to the wh-element in a constituent question (cf. Paul 1880). That is, focus is used to express question-answer congruence. This is illustrated in the following example:

(1) a. S_1: *Who won the first prize?* S_2: *ED*$_F$ *won the first prize.*
b. S_1: *Which price did Ed win?* S_2: *Ed won the FIRST*$_F$ *prize.*

We can assume that the wh-constituent constitutes the focus of the question, and that question and congruent answer share their focus position. In languages with a dedicated focus position, the wh-constituent is realized in that position (cf. #). And the wh-element is prosodically highlighted in in-situ constructions or when it is part of a wh-moved phrase (cf. Haida 2008):

(2) a. *Ed won WHICH prize?*
b. *The author of WHICH book won a prize?*

But it is possible that a question carries additional focus. One type is focus in polar questions, as in the following examples, where focus F is realized as a H* nuclear accent. This kind of focus can also be realized by a cleft sentence.

(3) S_1: *Did ED*$_F$ *win the first price?* S_2: *Yes.*
Is it ED$_F$ *who won the first price?* *#No. / No, ANN won the first prize.*

It is characteristic for this type of focus in polar questions that a simple answer *no* is felt to be insufficient. With a *no* answer, the issue remains who won the first price, and this question begs for an answer.

There is a second type of focus in questions. This focus is realized by a L+H* contour, and can optionally be expressed by an *as for* construction. This is evidence that it is a contrastive topic (Büring 2003), or delimiter (Krifka 2008). With polar questions, the anwer patterns are different, as a simple *no* answer is felt to be complete:

(4) S_1: *I want to know which of your students won a prize.*
Did ED$_{CT}$ *win a prize?* S_2: *Yes.*
As for ED$_{CT}$*, did HE*$_{CT}$ *win a prize?* *No.*

Contrastive topics also occur in constituent questions:

(5) S_1: *I want to know which prizes our students won.*
Which prize did ED$_{CT}$ *win?* S_2: *ED*$_{CT}$ *won the SECond*$_F$ *prize.*
As for ED$_{CT}$*, which prize did he win?*

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The change of predicate, from *won the first prize* to *won a prize,* is not by accident. For a declarative sentence with contrastive topic to be felicitous, it should not consitute a full answer. This is illustrated in the following example.

(6) S_1: *I want to know which of your students won the first prize.*
 a. (#) *Did* ED_{CT} *win the first prize?*
 b. # *As for* ED_{CT}, *did* HE_{CT} *win the first prize?*

Here, (a) actually is acceptable under the reading Ed_F, because the the L+H* accent and the H* accent are difficult to distinguish. For a recent work on the realization and the meaning of contrastive topics, cf. Constant (2012); for the realization of contrastive topics in other languages, cf. Sturgeon (2006) on Czech, Tomioka 2010 on Japanese, Kamali & Büring 2011 on Turkish, and Dukova-Zheleva 2010 on Bulgarian.

In this paper, I will develop a framework of discourse in which focus in answers to constituent questions, focus in polar questions, and contrastive topics in questions and their corresponding answers, can be modeled. Conversational moves are modeled as illocutionary acts in a novel framework based on commitment states of the interlocutors, and the ways how such commitment states can develop (cf. Cohen & Krifka 2013 for this model).

2. A Framework for Illocutionary Acts

What is an act? Something that changes the world in one way or other. Speech acts are no different: They produce some utterance or other (the locutionary act), and by this they produce a certain communicative effect (the illocutionary act, cf. Austin 1961). It is this illocutionary act that I will try to model here.

Changes of the world are functions from world-time indices to world-time indices, hence they have a semantic type (cf. Szabolcsi 1982, cf. also Singh 1993), which allows for illocutionary acts to be embedded under semantic operators (cf. Krifka 2014). Here, we will give a formal model of such changes, following Cohen & Krifka (2013). The two crucial assumptions are: Illocutionary acts change the commitments of the interlocutors, and they might restrict the future development of the commitments.

The fundamental notion is the notion of a **commitment state**. This is a set of commitments that are publicly shared by the participants, and which will typically increase in the course of conversation. It is related to the well-known notion of common ground as a set of propositions of which the interlocutors assume that they all hold them true with respect to the actual situation, at least for the purpose of communication (cf. Stalnaker 1979).

The basic function of a speech act is to change a commitment state, typically by adding new commitments to the commitment state. We will use letters $\mathfrak{A}$, $\mathfrak{B}$ for speech acts (specifically, for illocutionary acts). Using the ad-hoc notation $\mathfrak{A}_\varphi$ for an illocutionary act that adds the proposition φ to the commitment state c, we can use the following notation and graphical illustration:

(7) Update of commitment state c with speech act $\mathfrak{A}_\varphi$:
 $c + \mathfrak{A}_\varphi = c \cup \varphi$,
 where φ: the set of commitments introduced by speech act $\mathfrak{A}_\varphi$.

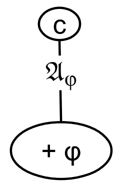


Figure 1: Update of commitment state

The crucial proposal that extends the usual notion of common ground is that we also model the possible orderly or "legal" continuations of a commitment state. We call this a **commitment space** (CS), and model it as a set of commitment states that also includes the non-empty intersection of these sets. This intersection is called the **root** of the commitment space; it is the commitment state that the interlocutors currently agree upon.

(8) C is a Commitment Space iff
   a. C is a set of commitment states, and
   b. there is a smallest commitment state in C: $\exists c \in C\ \forall c' \in C\ [c \neq \varnothing \wedge c \subseteq c']$
   This unique c (= $\cap$C) is the **root** of C, written $\sqrt{C}$.

Commitment states must be consistent, in the sense that they should not contain blatant contradictions, like a proposition φ and its negation, $\neg\varphi$. This is a principled restriction for the commitment states of commitment spaces.

For any two commitment states c, c′ in a commitment space C, it holds that c can develop into c′ iff $c \subset c'$. In case it holds that $c \subset c'$ and there is no $c'' \in C$ such that $c \subset c'' \rightarrow c'$, then this is a minimal transition between c and c′. The notion of update of a commitment state by an illocutionary act can be generalized to commitment spaces, as follows; the picture represents this update graphically.

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

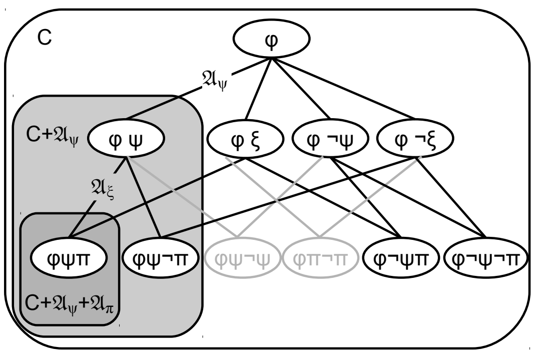


Figure 2: Update of a commitment space C with $\sqrt{C}$ = {φ}, and four update options. Inconsistent states are grayed out.

Figure 2 illustrates this situation with a commitment space C that has as root $\{\varphi\}$, and there are four continuations, the propositions ψ and π and their negation. Contradictory states are grayed out. The figure illustrates update of $\{\varphi\}$ with the proposition ψ, followed by update with π. Lines are read as transitions from top to bottom; if there is no intervening node, then we have a direct transition.

The main application of commitment spaces will result in a novel modeling of questions. Here I would like to mention another use of commitment spaces. It has been known since Searle (1969) that speech acts can undergo some sort of negation, called **denegation**, as in the following example:

(10) *I don't promise to come* ($\neq$ *I promise not to come*).

Notice that this does not mean, *I promise not to come*. Denegations have sometimes been expressed by simply adding a regular negation sign in front of a logical representation of a speech act (as in Searle 1969, or Searle & Vanderveken 1985, Vanderveken 1990). Hare (1970) proposed that in (10), the speaker explicitly refrains from a promise to come. We can model this as follows:

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

Figure 3 illustrates the denegation of the assertion of a proposition ψ and Figure 4, in contrast, the assertion of the negated proposition ¬ψ. Notice that denegation does not change the root of the commitment space, but prunes its legal developments. This is as it should be, because one could not say what the commitment expressed by (10) should be. We call such changes of a commitment space that do not change the root a **meta speech act**. Here I assumed that denegation $\sim\mathfrak{A}$ excludes all performances of $\mathfrak{A}$, which might not be realistic – the speaker can be persuaded and finally agree to come. Such moves would involve a change of the commitment space C to a C′ that is not just a subset of C, but includes options that were previously excluded. I will not attempt to model such more radical changes in this paper.

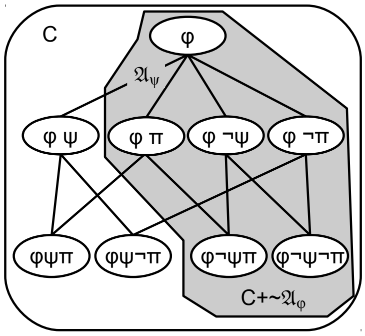


Figure 3: Denegation of ψ, $\sim\mathfrak{A}_\psi$

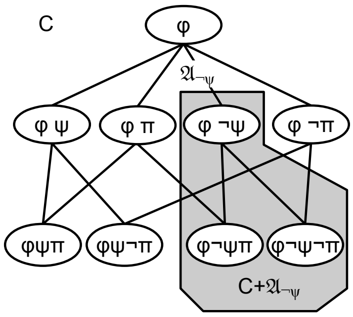


Figure 4: Assertion of ¬ψ, $\mathfrak{A}_{\neg\psi}$

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 some 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 $\langle C_0, C_1, \dots C_n\rangle$, and will call such sequences **Commitment Space Developments (CSD)**. Typically, we have $C_{i+1} \subset C_i$, that is, the immediate successor of a commitment space is included in its predecessor. But there are certain moves, like the radical change of a commitment space mentioned above and the REJECT operation to be discussed below, which do not obey this rule. The update of a CSD then consists in updating the last element of the CSD, and recording the result of this update at the end:

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

If necessary, we can indicate the participant that makes the conversational move in commitment space developments by subscripts. For example, $\langle ..., C\rangle +_{S1}\mathfrak{A} = \langle ..., C, [C{+}\mathfrak{A}]_{S1}\rangle$ marks a conversational move by S_1. In this paper, I will mostly leave this aspect implicit.

We have used the + notation to indicate the update of commitment states, commitment spaces, and commitment space developments. Note that + is just shorthand for functional application:

(13) 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 $\mathfrak{A} = \lambda C\{c\in C \mid \surd C + \mathfrak{A} \subseteq c\}$, for speech acts $\mathfrak{A}$
c. $\langle ..., C\rangle + \mathfrak{A} = \mathfrak{A}(\langle ..., C\rangle)$, where $\mathfrak{A} = \lambda\langle ...,C\rangle\ \langle ..., C, \mathfrak{A}(C)\rangle$, for speech acts $\mathfrak{A}$

How does this model relate to the idea that speech acts are index changers? Let us assume that for a communication situation s, the commitment state development CSD(s) up to the situation s is defined. When one participant performs a speech act $\mathfrak{A}$, then s changes minimally to that s′ such that CSD(s′) = CSD(s) + $\mathfrak{A}$. The new situation s′ may affect the proposition φ of a speech act $\mathfrak{A}_\varphi$, which might depend on s′ as a parameter, specifying a time, a world, or a location. However, this will be disregarded in the following.

It is obvious that the way how speech acts are modeled is inspired by modal logic. The type of modality involved is a new one beyond the known types of epistemic, deontic, or dynamic modality, a type related to the way what is allowed and disallowed in conversation. A commitment space and the inclusion relation that holds between the commitment states within it define the accessibility relation of this modality; a commitment state c′ is accessible from c with respect to C iff $c, c' \in C$ and $c \subseteq c'$.

3. Assertions

Having outlined the general framework for the representation of speech acts, we will now consider the speech act that is arguably most basic for human language, assertion. Without going into the varied literature on the nature of assertion (cf. the articles in Brown & Cappelen 2011 for a recent overview), I follow Brandom (1983), who highlights the social aspects of this conversational move; cf. also Alston (2001), and Linnell & Markova (2007), who stress that "illocutionary points are concerned with the assignment of epistemic and practical responsibilities, rights and obligations, to particular persons". In asserting a proposition, the speaker undertakes "justificatory responsibility" for what is claimed, in two ways: (i) by committing oneself to justify the proposition, and (ii) by licensing the assertion, and inferences from it, by others.

As for (i), I will say that when a speaker S_1 asserts a proposition φ to an addressee S_2, then S_1 expresses a **commitment** towards S_2 for the truth of φ. That is, if φ turns out to be false, then S_1 incurs social costs in his relationship to S_2, or to society at large. This is particularly so if S_1 believes that φ is false (in this case S_1 can be accused to be a liar), or in case S_1 did not have sufficient evidence for φ (in which case S_1 can be accused to be untrustworthy). The costs incurred depend on the circumstances; they may involve formal punishment if the assertion was done under oath in court, or they may reduce the credibility of the speaker for future conversational moves. I will call this the **truth commitment** of speaker S_1 to S_2.

As for (ii), S_1 wants to make φ to become a shared assumption of S_1 and S_2. I will call this move **proposition sharing**. The intention to make a proposition common ground is the most likely reason why S_1 committed to the truth of φ in the first place. This is nicely put in an essay by Peirce written around 1903 and published posthumously. Peirce talks about oaths and the potential punishments coming with them, and then writes:

> "(...) the assuming of responsibility, which is so prominent in solemn assertion, must be present in every genuine assertion. For clearly, every assertion involves an effort to make the intended interpreter believe what is asserted, to which end a reason for believing it must be furnished. But if a lie would not endanger the esteem in which the utterer was held, nor otherwise be apt to entail such real effects as he would avoid, the interpreter would have no reason to believe the assertion (CP 5.546, 1908).

There is evidence that having S_2 believe the asserted proposition φ is not the very essence of assertion but an intended consequence of the expression of commitment (hence, it is a **perlocutionary** act, cf. Austin 1962). Note that the speaker can explicitly refrain from this goal:

(14) *Believe it or not, Ed met Beth.*

If we analyze assertions as intentions of S_1 to make S_2 believe φ (cf. Bach & Harnish 1982), then (14) would be blatant contradiction. So, what is the status of the proposition sharing? It is certainly an important feature of assertions, but (14) shows that it can be cancelled. Consequently, we should assume that it has the status of a conversational implicature.

Assertions have also be understood as expressing the belief that a proposition is true. However, this cannot be the essence of assertions either, for otherwise the following two assertions would have nearly the same meaning.

(15) a. *Ed met Beth.*
b. *I believe that Ed met Beth.*

In fact, (15)(b) is not a commitment to the proposition that Ed met Beth, but a commitment to the proposition of having a belief that Ed met Beth. It is easy to see why this can be used as a weak assertion: The belief of one person can be a good reason that others believe the same, but expressing just a belief, and not a binding commitment, to a proposition mitigates the social consequences if the content of the belief should turn out to be false.

But what should we do about Moore's paradox, which seems to say that the expression of belief in a proposition is essential for the assertion of that proposition?

(16) *# Ed met Beth, but I don't believe it.*

The paradoxical nature of (16) can be derived from the fact that it is self-defeating to commit to the truth of a proposition (which carries risks if it is not true), and at the same time commit to the proposition that one believes that it is not true. The resulting commitment state would be contradictory not for logical, but for moral reasons. The essence of assertion is to commit oneself publicly to the truth of a proposition, and there is a moral rule not to commit to the truth of a proposition that is false. If one publicly states that one believes a proposition not to be true, then one would blatantly violate this moral rule.

I will implement the content of the truth commitment of S_1 towards S_2 for the proposition φ using Frege's "Urtheilsstrich", and write $S_1[S_2]\vdash\varphi$. For the purpose of this paper it is not necessary to specify the addressee, and so I will generally just write $S_1\vdash\varphi$. This is to be understood as a proposition, a function from indices to possible worlds, which we can render as λi[at i, S_1 is committed to the truth of proposition φ towards S_2]. The nature and strength of that commitment can vary, e.g. from a guess to an oath, and it might be evidentially qualified, e.g. as hearsay or by reference to a source, but we will not be concerned with this here. The truth commitment itself I will write as $+ S_1\vdash\varphi$, which is a function that changes a commitment state c such that it adds the proposition $S_1\vdash\varphi$. Similarly, I will implement the act of sharing the proposition φ as $+ \varphi$, which is a function that changes the commitment state c to $c \cup \{\varphi\}$. As we have seen, these functions can be lifted to one that is defined for commitment spaces, and for commitment space developments, cf. (13).

The two acts that make up a standard assertion are executed one after the other. The first and most important one is the truth commitment; the second, arguably an implicated consequence of the first, the proposition sharing. The natural way to implement this is by performing the two acts in a sequence, as defined and illustrated below.

(17) $\langle ..., C\rangle + S_1\vdash \varphi + \varphi$
$= \langle ..., C + S_1\vdash\varphi,$ truth commitment,
$C + S_1\vdash\varphi + \varphi\rangle$ proposition sharing

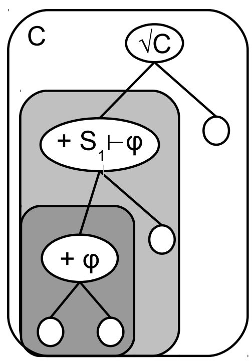


Figure 5: Assertion of φ

Note that the second move, $+\varphi$, corresponds to the "projected set", and the first move, $+S_1\vdash\varphi$, to the commitments of S_1 in the framework of Farkas & Bruce (2011). But in contrast to this work, a permanent record is kept for which person is committed to which proposition.

How are assertions formally expressed? I assume that they come about by an syntactic operator that take an expression that denotes a proposition (of the category TP) and change it to an illocutionary act, a function from CSDs to CSDs. Just like tense in the TP, this operator should be a head in its own syntactic projection. I will call this syntactic projection ForceP, and I will render it by the punctuation sign that is most closely associated with assertion, the full stop. I assume the following syntactic structure:

(18) $[_{\text{ForceP}}\ [_{\text{Force}'}\ [_{\text{Force}^{\text{o}}}\ .\ ]\ [_{\text{TP}}\ \textit{Ed met Beth}]]]$

I have assumed that the subject has moved from SpecTP to SpecForceP, and the tensed verb to the head position of ForceP. An alternative would be to assume that the finite verb moves to Force$^{\text{o}}$, and the subject to SpecForceP. Associating the final movement of the verb with expressing a speech act is reminiscent of Truckenbrodt (2006), who assumes that this move creates verb second in German, and is associated with an illocutionary force.

Semantic interpretation is with respect to a function $[\![...]\!]^{S1,S2}$ that specifies the speaker S_1, the addressee S_2 and additional parameters like the communicative situation and, with it, the world-time index of interpretation, which are suppressed here. The TP is interpreted as a proposition, and the assertion operator . is interpreted as a function that turns a proposition into a speech act that adds the truth commitment of the speaker to a commitment. In terms of Stenius (1968), the TP is the sentence radical of an assertion, and . is the illocutionary operator.

(19) $[\![[_{\text{ForceP}}\ [_{\text{Force}^{\text{o}}}\ .\ ]\ [_{\text{TP}}\ \textit{Ed met Beth}]]]\!]^{S1,S2}$
$= [\![[_{\text{Force}^{\text{o}}}\ .]]\!]^{S1,S2}([\![[_{\text{TP}}\ \textit{Ed met Beth}]]\!]^{S1,S2})$
$= \lambda p\ \lambda\langle..., C\rangle\ [\langle..., C, C + S_1[S_2]\vdash p\rangle]([\![[_{\text{TP}}\ \textit{Ed met Beth}]\!]^{S1,S2})$
$= \lambda\langle..., C\rangle\ [\langle..., C, C + S_1[S_2]\vdash[\![[_{\text{TP}}\ \textit{Ed met Beth}]]\!]^{S1,S2}\rangle]$
$= +\ S_1\vdash\varphi_b$, for short.

The second effect of assertion, proposing the proposition φ itself, should be a conversational implicature of the truth commitment, and hence needs no special operator. We might associate it with the nuclear stress H*, which indicates that the TP proposition is new (cf. Truckenbrodt 2012), which implies that it is added to the commitment state.

Let us now consider typical reactions to assertions. The truth commitment itself is typically immune to reactions. It can be targeted by comments like *Don't say that!* or *Don't be a fool*, but there is no grammaticized way to confirm or refute it. This reflects the fact that it is completely under the choice of the speaker to make it part of the commitment state.

As for the second act, proposition sharing, this can be addressed by the addressee. No reaction, or reactions like *uh-uh* or *okay* are understood as just accepting the proposal to share the proposition. They can be represented by an ACCEPT operator, defined as follows, where we have to indicate the participants that make the conversational move.

(20) $\langle..., C_{S1}\rangle +_{S2} \text{ACCEPT} = \langle..., C_{S1}, C_{S2}\rangle$

The commitment space does not change, but the same commitment space is added at the end of the CSD stack as a move by S_2.

Reactions like *Yes (he did)* or *No (he didn't)* are stronger because they express not only that the proposition is accepted to be part of the commitment state, but that the addressee as well declares a truth commitment towards it. I have proposed a model of how these response particles work in Krifka (2013). In essence, the TP of the assertion introduces a propositional discourse referent that is taken up by *yes* and *no* as anaphoric elements, which either assert the proposition or assert its negation. This is, then, how the answer *yes* works; it is illustrated in Figure 6.

(21) Answer *yes*: S_2 picks up and asserts the same proposition:
$\langle ..., C + S_1 \vdash \varphi, C + S_1 \vdash \varphi + \varphi \rangle + S_2 \vdash \varphi$
$= \langle ..., C + S_1 \vdash \varphi, C + S_1 \vdash \varphi + \varphi, C + S_1 \vdash \varphi + \varphi + S_2 \vdash \varphi \rangle$

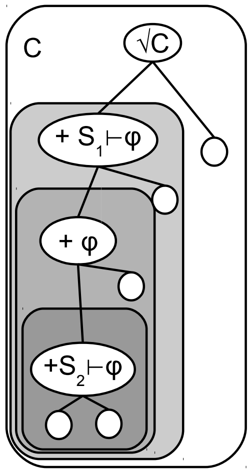


Figure 6: Answer *yes*

The answer *no* is more complex. It asserts the negation of φ, but this cannot be done directly, as the resulting commitment state would end up with the proposed proposition φ and the proposition $S_2 \vdash \neg\varphi$, that one of the participants is committed to the falsity of ¬φ. While this is not a logical contradiction, it is a pragmatic contradiction, and cannot be entertained in a commitment state. For this reason, the last move of proposition sharing of φ has to be rejected by S_2 first before $S_2 \vdash \neg\varphi$ can be added. We assume the following operator on commitment space developments, which rejects the last commitment space and returns the next-to-last commitment space:

(22) $\langle ..., C, C'_{S1} \rangle +_{S2} \text{REJECT} = \langle ..., C, C'_{S1}, C_{S2} \rangle$

After that REJECT operation, S_2 can assert the negation of φ:

(23) Answer *no*: S_2 picks up and negates the same proposition; for consistency, this requires a previous REJECT operation:
$\langle ..., C + S_1 \vdash \varphi, C + S_1 \vdash \varphi + \varphi \rangle +_{S2} \text{REJECT}^{S} +_{S2} S_2 \vdash \neg\varphi$
$= \langle ..., C + S_1 \vdash \varphi, C + S_1 \vdash \varphi + \varphi,$
$C + S_1 \vdash \varphi, C + S_1 \vdash \varphi + S_2 \vdash \neg\varphi \rangle$

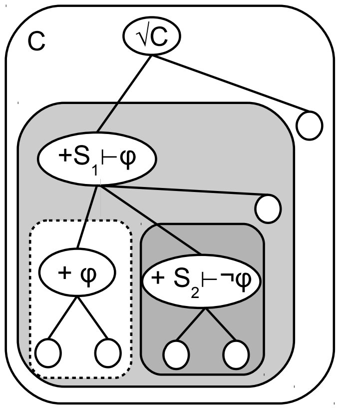


Figure 7: Answer no

See Figure 7 for illustration. Note that *no* itself does not reject, but enforces a prior rejection. This is as it should be, because in case the antecedent clause is negated, as in Error: Reference source not found, the answer *no* does not reject. See Krifka 2013 for an argument that a negated TP introduces a non-negated propositional discourse referent.

(24) S_1: *Ed didn't meet Beth.*
S_2: *No, he didn't.*

4. Constituent Questions

We now turn to questions, and will first tackle to constituent questions, also called wh-questions due to the typical way how they are expressed in English. Let us first look at the sentence radicals of questions, which occur in questions embedded under predicates like *know* or *find out.* I will model them as sets of propsotions, following Hamblin (1973). For example, the embedded question *who Ed met* is supposed to form a CP with the wh-constituent in specifier position, and a set of propositions as interpretation.

(25) $[\![[_{CP}\, \textit{who}\ [_{TP}\ \textit{Ed met}\ t_{who}]]]\!]^{S1,S2}$
$= \{\lambda i[\text{Ed stole x in i}] \mid x \in \text{PERSON}\}$
$= \{\lambda i[\text{Ed met Ann in i}], \lambda i[\text{Ed met Beth in i}], \lambda i[\text{Ed med Carla in i}]\}$
$= \{\varphi_a, \varphi_b, \varphi_c\}$

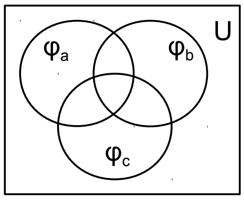
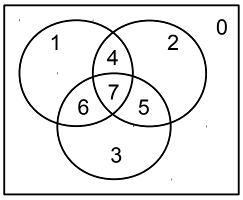


Figure 8: Constituent question radical

Figure 8 gives a representation by a Venn diagram. – Groenendijk & Stokhof (1982) have proposed an alternative representation, in which questions denote a partition of the set of possible worlds. They propose a different interpretation algorithm, but the partitional analysis can be derived from the Hamblin meaning by an optional pragmatic exhaustification operation denoted by $\overline{\cap}$:

(26) Let M be a set of sets drawn from a universe U,
then $\overline{\cap}M = \{X \mid \exists M' \subseteq \overline{M}[X = \cap M' \wedge X \neq \emptyset \wedge$
$\neg\exists M'' \subseteq \overline{M}[\cap M'' \subset \cap M']]\}$,
where $\overline{M} = \{X \mid X \in M \vee \overline{X} \in M\}$,
and $\overline{X} = U - X$



$\overline{\cap}\{\varphi_a, \varphi_b, \varphi_c\}$
Figure 9: Exhaustification

Figure 9 shows the result of exhaustification of the situation in Figure 8. Note that without the minimization clause $\neg\exists M'' \subseteq \overline{M}[\cap M'' \subset \cap M']$ we would get all Boolean combinations of the original propositions φ_a, φ_b, φ_c.

Assuming an optional pragmatic exhaustification operation means that we have semantically a weak interpretation of questions that can be strengthened pragmatically. This is different from Groenendijk & Stokhof's approach, who assume a strong semantic interpretation of questions that can be weakened for pragmatic reasons.

Question radicals occur as embedded questions, as in the following example (here without exhaustification):

(27) $[\![[_{TP}\ \textit{Dan knows}\ [_{CP}\ \textit{who}\ [_{TP}\ \textit{Ed met}\ t_{wh}]]]]\!]^{S1,S2}$
$= \lambda i \forall p \in [\![[_{CP}\ \textit{who}\ [_{TP}\ \textit{Ed met}\ t_{wh}]]\!]^{S1,S2}\, [p(i) \rightarrow [\![\textit{know}]\!](i)(p)([\![\text{Dan}]\!])]$
$= \lambda i \forall p \in \{\varphi_a, \varphi_b, \varphi_c\}[p(i) \rightarrow \text{Dan knows that p in i}]$

This is a proposition that is true at indices i for which it holds that for all questions φ_a, φ_b, φ_c, if they are true in i, then Dan knows that they are true in i.

Just as a TP was the truth-conditional semantic core of an assertion, an interrogative CP is the truth-conditional semantic core of a question act. I assume an operator "?" as head of the ForceP of a question act. This has to be identified by the finite verb moving into this position, which is only possible for auxiliary verbs. Thus, we have the following structure:

(28) $[_{ForceP}\ \textit{who}\ [_{Force^\circ}\ ?\text{-}\textit{did}\ [_{CP}\ t_{who}\ [_{TP}\ \textit{Ed}\ t_{did}\ \textit{meet}\ t_{who}]]]]]$

What does a question speech act mean? We do not have to invent a new basic move, as questions try to elicit other speech acts, typically assertions, and we already have a way to represent assertions. We can understand questions as **projected assertions**, typically for the other speaker. We can model the effect of this conversational move because we have commitment spaces that specify how commitment spaces are allowed to develop towards the future. Hence, we can model question acts as meta speech acts in which all immediate continuations that do not form a congruent answer are excluded:

(29) $\langle ..., C\rangle +_{S1} \llbracket[_{ForceP}[[?]\ [_{CP}...]]]\rrbracket^{S1,S2}$
$= \langle ..., C, \cup\{\{\surd C\} +_{S1}\ S_2{\vdash}p \mid p{\in}\llbracket[_{CP}...]\rrbracket^{S1,S2}\}\rangle$
$= \langle ..., C, \{\surd C\} \cup \cup\{C +_{S1} S_2{\vdash}p \mid p \in\llbracket[_{CP}...]\rrbracket^{S1,S2}\ \}\rangle$
$= \langle ..., C, \{\surd C\} \cup \cup\{C +_{S1} S_2{\vdash}p \mid p{\in} \{\varphi_a, \varphi_b, \varphi_c\}\}\rangle$
$= \langle ..., C, \{\surd C\} \cup C +_{S1} S_2{\vdash}\varphi_a$
$\cup\ C +_{S1} S_2{\vdash}\varphi_b$
$\cup\ C +_{S1} S_2{\vdash}\varphi_c\rangle$
$= \langle ..., C, C'\rangle$

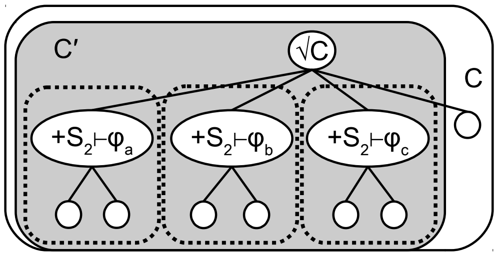


Figure 10: Constituent Question

Notice, first, that this is a conversational move by the speaker S_1. It consists of proposing a commitment space that consists of the root of the original commitment space, √C, updated by truth commitments of the **other** speaker, S_2, for each of the propositions in the set denoted by the question radical. The question operator ? then is interpreted as follows; recall that S_1 refers to the speaker, that the move is initiated by S_1 but asks for assertions by S_2,

(30) $\llbracket ?\rrbracket^{S1,S2} = \lambda P\ \lambda\langle ..., C\rangle\ [\ \langle ..., C, \cup\{\{\surd C\} +_{S1} S_2{\vdash}p \mid p{\in} P\}\rangle]$

What are the possible reactions to a question? In a fully congruent answer, the addressee simply performs one of the proposed assertions, thus restricting the commitment space.

(31) Fully congruent answer:
e.g. (29) + $\llbracket[_{ForceP}\ [\ [_{Force^\circ}.\ ]\ [_{TP}\ \textit{Ed met Beth}]]]\rrbracket^{S2,S1}$
$= \langle ..., C, C', \{c{\in} C' \mid \surd C' +_{S2} S_2{\vdash}\varphi_b \subseteq c\}\rangle$

As with assertions in general, this move also implicates the move $+_{S1}\ \varphi_b$. The overall effect is given in Figure 11.

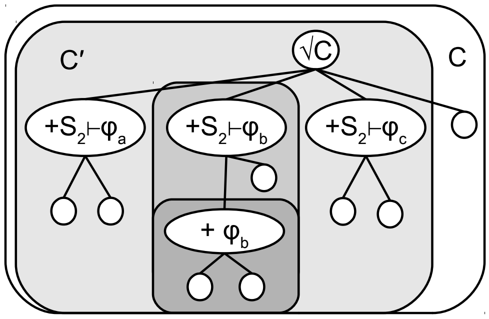


Figure 11: Fully congruent answer

We often understand answers to constituent questions exhaustively. This can be achieved in one of two ways. First, we can assume that exhaustification $\overline{\cap}$ has applied at the level of the CP. In this case, we have proposed assertions based on propositions like ‘Ed met only Beth’ that are semantically exhaustive. Alternatively, we can assume that the answer triggers a conversational implicature that the alternative answers are excluded. This can be modeled as denegation. In this case, the speaker explicitly withholds opinion about the proposition. This difference constitutes a way to differentiate between semantic exhaustivity as expressed by *only*, and pragmatic exhaustivity as expressed by scalar implicatures.

A question can also be rejected, e.g. by *I don’t know* or *I won’t tell you.* This refusal to answer requires a previous REJECT operation, which makes the last speaker undo. This is illustrated in the following example, and in Figure 12.

(32) Refusal to answer, e.g.: *I don’t know.*
(31) $+_{S2}$ REJECT
$+_{S2}\ \llbracket[_{ForceP}\ [[.]\ [_{TP}\ \textit{I don't know who Ed met}]]]\rrbracket^{S2,S1}$
$= \langle ..., C, C'_{S1}\rangle +_{S2}$ REJECT
$+_{S2}\ S_2{\vdash}\llbracket[_{TP}\ \textit{I don't know wh Ed met}]\rrbracket^{S2,S1}$
$= \langle ..., C, C'_{S1}, C_{S2}\rangle$
$+_{S2}\ S_2{\vdash}$
$\lambda i[\forall p{\in} \{\varphi_a, \varphi_b, \varphi_c\}[p(i) \rightarrow \neg S_2 \text{ knows } p \text{ at } i]$
$= \langle ..., C, C'_{S1}, C_{S2}, C +_{S2} S_2{\vdash}\neg K\varphi_a{\wedge}\neg K\varphi_b{\wedge}\neg K\varphi_c\rangle$

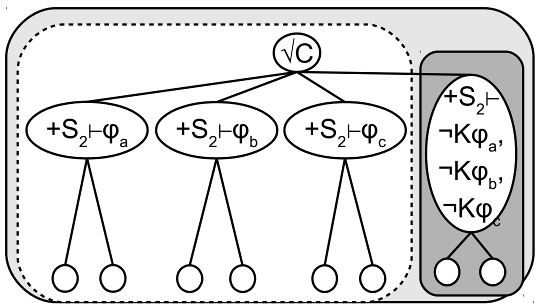


Figure 12: Refusal to answer

Here, $\neg K\varphi_a$ stands for ‘S_2 does not know that φ_a’

There are many possible reactions to questions that are neither fully congruent answers, nor refusals to answer, but answer a question partially, by excluding certain options – e.g. *Ed met Ann or Beth*, or *Ed met Ann, but not Beth.* Let us look as an example at the answer *Ed didn’t meet Beth*. In case the question radical is exhaustive, then this would mean that Ed met Ann and Carla and nobody else. We will consider the case in which the question radical is not exhaustive, which leaves the options that Ed met Ann or Beth. How can we model such excluding answers? One option is to assume a REJECT operation, followed by the assertion that Ed did not meet Beth. But there is another option as well. First, notice that update of (29) with the assertion *Ed didn’t meet Beth* is possible, even though this is not a move that is proposed as an immediate move.

(33) $C' +_{S2} [\![[_{\text{ForceP}} [[.]$ *Ed didn’t meet Beth*$]]]]^{S2,S1}$
$= \{c\in C \mid \surd C + S_2\vdash\neg\varphi_b \subseteq c\}$
$= C''$

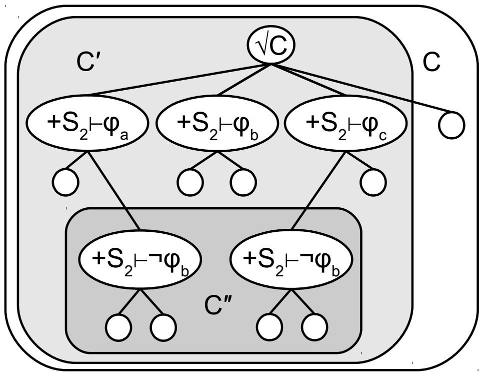


Figure 13: Excluding one alternative.

This adds to each of the proposed assertions the truth commitment $S_2\vdash\neg\varphi_b$, cf. Figure 13. As this is not compatible with the proposed assertion $+S_2\vdash\varphi_b$, the branch started with this assertion is discontinued; that is, as C only consists of coherent commitment states, there is no successor of $+S_2\vdash\varphi_b$ that would contain $S_2\vdash\neg\varphi_b$.

But there is a problem: The resulting set of commitment state is not a commitment space, as it lacks a root. I would like to propose that in case un update results in a set of commitment states that does not result in a rooted commitment space, there is a pragmatic rescue operation of re-rooting, which can be defined as follows:

(34) Re-rooting operation: $\circ C = \{\cap C\} \cup C$

This adds to C the commitment state that is the intersection of all commitment states in C. If this intersection $\cap C$ is not empty, then it is the root of $\circ C$. In the case at hand, we have $\cap C'' = \surd C + S_2\vdash\neg\varphi_b$, which becomes the root of the resulting commitment space:

(35) $\circ C'' = \{\surd C + S_2\vdash\neg\varphi_b\} \cup C''$
$= C'''$

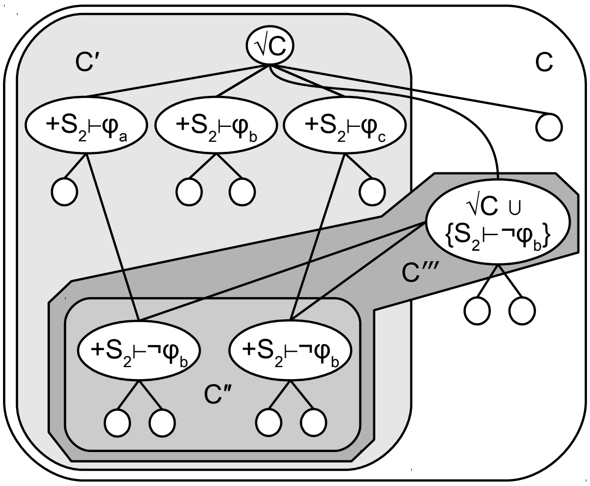


Figure 14: Re-rooting

As Figure 14 illustrates, after re-rooting we get a commitment space in which the remaining question is *Who did Ed meet?*, where *Ed met Beth* has been eliminated.

This question could be answered in the next move, as in *Ed met Ann.* But more likely it will not be answered, as S_2 could have answered the initial question directly in this way. Other continuations, like *The weather was nice.* as an assertion by S_2, can be treated by a similar update of the resulting commitment state C''' and a re-rooting operation, as illustrated in Figure 15. In this way, the commitment space keeps track of questions that remained unanswered.

Notice that we can assume the rooting operator ◦ in all the cases we have considered so far as well, for we have for rooted commitment states C that ◦C = C. In particular, we can redefine (13)(b) as follows:

(36) $C + \mathfrak{A} = \mathfrak{A}(C)$,
where $\mathfrak{A} = \lambda C\ [\circ\{c \in C \mid \surd C + \mathfrak{A} \subseteq c\}]$

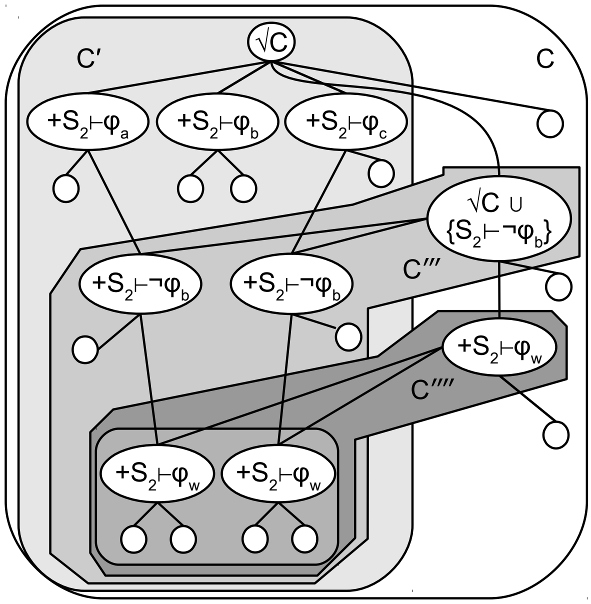


Figure 15: Additional assertion requiring re-rooting

In closing this session, it should be stated that this treatment of questions and answers is not entirely new. For example, in the dialogue games of Carlson (1983), questions are set-up moves whereas answers are pay-off moves. Similarly, Farkas & Bruce (2010) have the notion of putting a proposition on the table, which requires a reaction by the addressee. The notion of commitment space that might be narrowed down by asking a question appears to be more flexible. It is arguably a good tool to capture the notion of common ground management, cf. Krifka (2008), as specifying the ways into which a common ground can develop.

5. Focus and question/answer congruence

We now turn to question-answer congruence, as in the following case:

(37) S_1: *Who did Ed meet?*
S_2: *Ed met BETH*$_F$

Having started with a Hamblin-style representation of questions, it is plausible to make use of alternative semantics as modeling the focus in answers (cf. Rooth 1992). This is what we get on the TP level, where ⟦...⟧ specifies the ordinary semantic value, and $⟦...⟧_f$ the focus-induced set of alternative meanings.

(38) a. $⟦[_{TP}\ \textit{Ed met BETH}_F]⟧^{S2,S1} = \lambda i[\text{Ed met Beth in i}]$
b. $⟦[_{TP}\ \textit{Ed met BETH}_F]⟧_f^{S2,S1} = \{\lambda i[\text{Ed met x in i}] \mid x \in \text{THING}\} = \{\varphi_a, \varphi_b, \varphi_c, \varphi_d\}$

Alternatives spread to the ForceP level and lead to illocutionary alternatives:

(39) a. $⟦[_{ForceP}\ [[.]\ [_{TP}\ \textit{Ed met BETH}_F]]]⟧^{S2,S1} = +S_2\vdash\varphi_b$
b. $⟦[_{ForceP}\ [[.]\ [_{TP}\ \textit{Ed met BETH}_F]]]⟧_f^{S2,S1} = \{+S_2\vdash\varphi_a, +S_2\vdash\varphi_b, +S_2\vdash\varphi_c, +S_2\vdash\varphi_d\}$

The alternative illocutions indicated by focus restrict the situations in which the ordinary illocution can be acted out. We assume that in general, a speech act is licit for a commitment space C only if C is identical to the disjunction of all the updates of C with one of the alternative acts. The pragmatic rule for act $\mathfrak{A}$ with alternatives $\mathfrak{A}_f$ is then as follows:

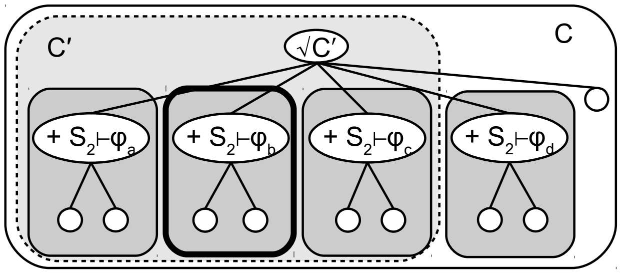


Figure 16: wh question, answer with focus alternatives

(40) $C + \mathfrak{A}$ is defined only if:
$$C = \circ\bigcup\{C{+}A \mid A{\in}\mathfrak{A}_f\}$$
$$= \circ\bigcup\{\{c{\in}C \mid \surd C{+}A \subseteq c\} \mid A{\in}\mathfrak{A}_f\}$$

To show that (39) satisfies this requirement in the context (29), after the question *Who did Ed meet?,* we have to show the following:

(41) $C' = \circ\bigcup\{C'{+}A \mid A{\in} \{{+}S_2{\vdash}\varphi_a, {+}S_2{\vdash}\varphi_b, {+}S_2{\vdash}\varphi_c, {+}S_2{\vdash}\varphi_d\}\}$
where $C' = \{\surd C\} \cup C{+}S_2{\vdash}\varphi_a \cup C{+}S_2{\vdash}\varphi_b \cup C{+}S_2{\vdash}\varphi_c$

This is indeed the case, as Figure 16 shows. In particular, we have that $C' + S_2{\vdash}\varphi_d$ does not introduce additional commitment states, as $\surd C' \cup \{S_2{\vdash}\varphi_d\}$ is not in C', and all other continuations of $\surd C'$ in C' occur in one of the three continuations that are already specified.

The alternative assertions generated by focus do not only check the context in which they are uttered, they also induce a **scalar implicature**, namely that the assertion that is actually made is the only one that can be made. We can express this scalar implicature nicely in the framework developed here, by assuming that all the other assertion alternatives within C' are denegated. In our example, S_2 denegates $S_2{\vdash}\varphi_a$ and $S{\vdash}\varphi_b$. We can define an update strengthened by implicature, for which we write ++, and which is defined as follows:

(42) Scalar implicature, triggered by assertion $\mathfrak{A}$ with alternatives $\mathfrak{A}_f$:
$$C \mathbin{++} \mathfrak{A} = [C + \mathfrak{A}] \cap \bigcap\{C + {\sim}A \mid A \in \mathfrak{A}_f\}$$

In our example, S_2 denegates the alternative assertions $S_2{\vdash}\varphi_a$ and $S{\vdash}\varphi_c$. Notice that this is weaker than the assertions $S_2{\vdash}\neg\varphi_a$ and $S_2{\vdash}\neg\varphi_c$ because after the denegation, S_2 is not committed to any of the propositions φ_a, $\neg\varphi_a$, φ_c, $\neg\varphi_c$. All that S_2 has done, officially, is to remain silent about these propositions.

It should be mentioned that focus-induced alternatives on illocutionary acts may also **accommodate** an appropriately restricted input commitment space. These are the implicit questions assumed in many frameworks.

6. Polar Question and Alternative Question Radicals

We now turn to polar questions, also known as yes/no-questions due to the typical way how they are answered in English. We again first look at the question radicals that appear in embedded questions, in particular at questions with the complementizer *whether*. The standard account of *whether* questions is that they denote a proposition and its negation:

(43) $[\![[_{CP}\ \textit{whether}\ [_{TP}\ \textit{Ed met Beth}]]]\!] = \{[\![[_{TP}\ \textit{Ed met Beth}]]\!], \neg[\![[_{TP}\ \textit{Ed met Beth}]]\!]\},$
$= \{\varphi_b, \neg\varphi_b\}$

The problem with this representation of *whether* questions is that it assigns the same meaning to the following CPs:

(44) a. [$_{CP}$ *whether Ed met Beth*].
b. [$_{CP}$ *whether Ed didn't meet Beth*].
c. [$_{CP}$ *whether Ed met Beth or not*].

This might be not much of a problem when we look at these CPs in the context of *Dan found out* [$_{\text{CP}}$ …], which arguably lead to the same truth conditions. But the truth conditions are subtly different under *wondered,* and clearly distinct under *doubt*, where (c) would be anomalous. There are proposals for distinct representations, such as Biezma & Rawlins (2012), who propse that (a) denotes a proposition with its negation as a salient alternative, and (b) denotes a set of two propositions.

Here I will propose that *whether* is an operator that, just like other wh-elements, creates an interrogative meaning, as usual of the type of a set of propositions. But it does so by creating a **singleton** set of propositions, resulting in what I would like to call a **monopolar** question radical.

(45) $\llbracket$[$_{\text{CP}}$ *whether* [$_{\text{TP}}$ *Ed met Beth*]]$\rrbracket$ = {$\llbracket$[$_{\text{TP}}$ *Ed met Beth*]$\rrbracket$} = $\{\varphi_b\}$

We could assign *whether* a meaning $\lambda p\{p\}$ that would achieve this interpretation. – As we have seen in the case of constituent questions, cf. (26), question meanings can be pragmatically strenghtened by exaustification. In the case of a *whether*-question, this leads to the usual representation as a set containing two propositions, one being the negation of the other, which we will call the **bipolar** interpretation.

(46) $\overline{\cap}\{\varphi_b\} = \{\varphi_b, \neg\varphi_b\}$

Of course, exhaustifying [$_{\text{CP}}$ *whether Ed didn't meet Beth*] leads to exactly the same result. Hence while (44)(a) and (b) are semantically different, they are pragmatically equivalent after exhaustification.

Questions like (44)(c) belong to the paradigm of alternative questions, and for that we also have to consider examples like the following:

(47) [$_{\text{CP}}$ *whether* [$_{\text{TP}}$ [$_{\text{TP}}$ *Ed met ANN*$_{\text{F}}$] *or* [$_{\text{TP}}$ *Ed met BETH*$_{\text{F}}$]]]

As is well-known, these questions have obligatory focus on the disjuncts; this holds for (44)(c) as well (with focus on [*Ed met Ann*] and [*not*]). We assume, as usual, that focus induces alternatives, and that the alternatives of the constituents of coordinations are constrained by each other (mediated by Rooth's squiggle operation, similar as in his case of *an AMERICAN*$_{\text{F}}$ *farmer met a CANADIAN*$_{\text{F}}$ *farmer*, cf. Rooth 1992). For our example, this means that we have the following focus alternatives on the TP level:

(48) a. $\llbracket$[$_{\text{TP}}$ *Ed met ANN*$_{\text{F}}$]$\rrbracket_{\text{f}}$ = $\{\varphi_a, \varphi_b\}$
b. $\llbracket$[$_{\text{TP}}$ *Ed met BETH*$_{\text{F}}$]$\rrbracket_{\text{f}}$ = $\{\varphi_a, \varphi_b\}$
c. $\llbracket$[$_{\text{TP}}$ [$_{\text{TP}}$ *Ed met ANN*$_{\text{F}}$] *or* [$_{\text{TP}}$ *Ed met BETH*$_{\text{F}}$]]$\rrbracket_{\text{f}}$
= {$p \vee p' \mid p \in$ $\llbracket$[$_{\text{TP}}$ *Ed met ANN*$_{\text{F}}$]$\rrbracket$ $\wedge\ p' =$ $\llbracket$[$_{\text{TP}}$ *Ed met BETH*$_{\text{F}}$]$\rrbracket$}
= $\{\varphi_a \vee \varphi_a, \varphi_a \vee \varphi_b, \varphi_b \vee \varphi_a, \varphi_b \vee \varphi_b\}$
= $\{\varphi_a, \varphi_b, \varphi_a \vee \varphi_b\}$
strenghtened to $\{\varphi_a, \varphi_b\}$, as $\varphi_a \vee \varphi_b$ is entailed by φ_a and φ_b

The last step of pragmatic strengthening is well motivated; for example, one cannot refute the sentence *Ed met only BETH* by pointing out that Ed also met Beth or Ann. We get the same meaning with a more narrow-scope disjunction, as in [*Ed met* [*ANN*$_{\text{F}}$ *or BETH*$_{\text{F}}$]]; in this case the focus interpretation spreads as usual from the embedded constituent to the clause.

The contribution of *whether* is to make the focus meaning the ordinary meaning; it corresponds to the Q operator in Beck (2006).

(49) a. $[\![[_{\mathrm{CP}}\ \textit{whether}\ [_{\mathrm{TP}} \ldots]]]\!] = [\![[_{\mathrm{TP}} \ldots]]\!]_{\mathrm{f}}$
b. $[\![[_{\mathrm{CP}}\ \textit{whether}\ [_{\mathrm{TP}} [_{\mathrm{TP}}\ \textit{Ed met ANN}_{\mathrm{F}}]\ \textit{or}\ [_{\mathrm{TP}}\ \textit{Ed met BETH}_{\mathrm{F}}]]]]\!] = \{\varphi_a, \varphi_b\}$

We can apply this way of interpreting also to (44)(c). I assume that focus is on the whole TP, and that *not* is an anaphoric element picking up an antecedent proposition and negating it (cf. Krifka 2013). We then get the following interpretation:

(50) a. $[\![[_{\mathrm{TP}} [_{\mathrm{TP}}\ \textit{Ed met BETH}]_{\mathrm{i,F}}\ \textit{or}\ [_{\mathrm{TP}}\ \textit{NOT}]_{\mathrm{i,F}}]]\!]_{\mathrm{f}} = \{\varphi_b, \neg\varphi_b\}$
b. $[\![[_{\mathrm{CP}}\ \textit{whether}\ [_{\mathrm{TP}} [_{\mathrm{TP}}\ \textit{Ed met BETH}]_{\mathrm{F}}\ \textit{or}\ [_{\mathrm{TP}}\ \textit{NOT}_{\mathrm{F}}]]]]\!] = \{\varphi_b, \neg\varphi_b\}$

Interestingly, the interpretation of *whether* in (49)(a) can also be assumed to induce monopolar question meanings if we assume that the TPs of such questions do not have a focus that is used by *whether*. Recall that is generally assumed in Alternative Semantics that for expressions without focus, the focus interpretation is the singleton set of the ordinary value.

(51) a. $[\![[_{\mathrm{TP}}\ \textit{Ed met Beth}]]\!]_{\mathrm{f}} = \{\varphi_b\}$
b. $[\![[_{\mathrm{CP}}\ \textit{whether}\ [_{\mathrm{TP}}\ \textit{Ed met Beth}]]]\!] = \{\varphi_b\}$

The question radicals we have derived can occur as embedded questions, just as the case with constituent questions:

(52) $[\![[_{\mathrm{TP}}\ \textit{Dan knows}\ [_{\mathrm{CP}}\ \textit{whether}\ [[_{\mathrm{TP}}\ \textit{Ed met BETH}]_{\mathrm{F}}\ \textit{or}\ [\textit{NOT}]_{\mathrm{F}}]]]]\!]$
$= \lambda i\ \forall p \in \{\varphi_b, \neg\varphi_b\}\ [p(i) \rightarrow \text{Dan knows that p in i}]$

The monopolar question would literally have a different interpretation:

(53) $[\![[_{\mathrm{TP}}\ \textit{Dan knows}\ [_{\mathrm{CP}}\ \textit{whether}\ [_{\mathrm{TP}}\ \textit{Ed met Beth}]]]]\!]$
$= \lambda i\ \forall p \in \{\varphi_b\}\ [p(i) \rightarrow \text{Dan knows that p in i}]$

Assume that φ_b is not true in i, then this says nothing about Dan's epistemic state towards φ_b. However, we typically understand this sentence as saying that Dan then knows that $\neg\varphi_b$. This stronger reading can come about by exhaustification of $[\![[_{\mathrm{TP}}\ \textit{Ed met Beth}]]\!]_{\mathrm{f}}$, which gives us $\overline{\cap}\{\varphi_b\} = \{\varphi_b, \neg\varphi_b\}$, and hence the same interpretation as (52). We can argue that the non-exhaustified reading in (53) is blocked because in case φ_b is true at i, then the same meaning can be expressed by the simpler *Dan knows that Ed met Beth*, and in case φ_b is false at i, the quantificational domain would be empty.

In the following section, we turn to question acts made on the basis of polar questions, and we will see that the difference between monopolar and bipolar questions is of great importance.

7. Polar Question Acts

Polar question acts can be derived in precisely the same way from their sentence radicals as with constituent questions, illustrated in (29). That is, we assume here an underlying *whether* CP that is turned into a question by the ? operator. Different from constituent questions, there is no overt wh-word in polarity questions. If we want to assume maximal similarity with constituent questions, we can assume that *whether* is moved but not pronounced, arguably because it is not licensed as a constituent within the TP, and its effects are expressed by verb-initial syntax in English. In the appendix, Section 10, I present a different way of constructing the syntax/semantics mapping in which question speech acts are not derived from the embedded questions, and consequently no *whether* deletion is required.

We first consider **monopolar** question acts. They are derived from *whether* CPs that do not undergo exhaustification. Figure 17 illustrates this with an example.

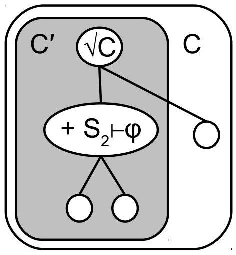


Figure 17:
Monopolar question

(54) $\langle ..., \mathrm{C}\rangle + [\![[_{\mathrm{ForceP}}\ \cancel{whether}\ [[_{\mathrm{Force^o}}\ ?\text{-}did]\ [_{\mathrm{CP}}\ \mathrm{t_{wh}}\ [_{\mathrm{TP}}\ Ed\ \mathrm{t_{did}}\ come]]]]]]\!]^{\mathrm{S1,S2}}$
$= \langle ..., \mathrm{C}, \{\surd\mathrm{C}\} \cup \bigcup\{\mathrm{C} + \mathrm{S_2}{\vdash}\mathrm{p} \mid \mathrm{p} \in [\![[_{\mathrm{CP}}\ \cancel{whether}\ [_{\mathrm{TP}}\ ...]]]\!]^{\mathrm{S1,S2}}\rangle$
$= \langle ..., \mathrm{C}, \{\surd\mathrm{C}\} \cup \bigcup\{\mathrm{C} + \mathrm{S_2}{\vdash}\mathrm{p} \mid \mathrm{p} \in \{\lambda i[\text{Ed came in i}]\}\}\rangle$
$= \langle ..., \mathrm{C}, \{\surd\mathrm{C}\} \cup \mathrm{C} + \mathrm{S_2}{\vdash}\lambda i[\text{Ed came in i}] + \lambda i[\text{Ed came in i}]\rangle$

Bipolar question are derived by the same underlying syntactic structure, after exhaustification. See Figure 18 for illustration.

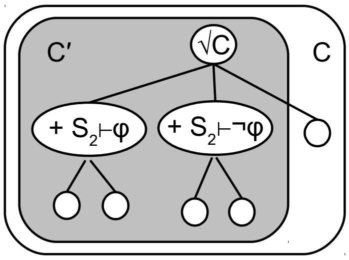


Figure 18: Bipolar question

(55) $\langle ..., \mathrm{C}, \{\surd\mathrm{C}\} \cup \bigcup\{\mathrm{C} + \mathrm{S_2}{\vdash}\mathrm{p} \mid \mathrm{p} \in \overline{\cap}\{\lambda i[\text{Ed came in i}]\}\}\rangle$
$= \langle ..., \mathrm{C}, \{\surd\mathrm{C}\} \cup \{\mathrm{C} + \mathrm{S_2}{\vdash}\mathrm{p} \mid \mathrm{p} \in \{\lambda i[\text{Ed came in i}],$
$\lambda i\neg[\text{Ed came in i}]\}\}\rangle$
$= \langle ..., \mathrm{C}, \{\surd\mathrm{C}\} \cup \mathrm{C} + \mathrm{S_2}{\vdash}\lambda i[\text{Ed came in i}]$
$\cup\ \mathrm{C} + \mathrm{S_2}{\vdash}\lambda i\neg[\text{Ed came in i}]\rangle$

The response particles *yes* and *no* are the standard ways to answer polar questions. I assume that they work in the same way as with assertions: They pick up the propositional discourse referent corresponding to the TP of the antecedent clause, $\varphi = \lambda i[\text{Ed came in i}]$ (cf. Krifka 2013).

(56) Congruent answers *yes*:

a. To bipolar question:
(55) + $[\![yes_\varphi]\!]^{\mathrm{S2,S1}}$
= (55) + $\mathrm{S_2}{\vdash}\varphi + \varphi$, a legal move.

b. To monopolar question:
(54) + $[\![yes_\varphi]\!]^{\mathrm{S2,S1}}$
= (54) + $\mathrm{S_2}{\vdash}\varphi + \varphi$, a legal move.

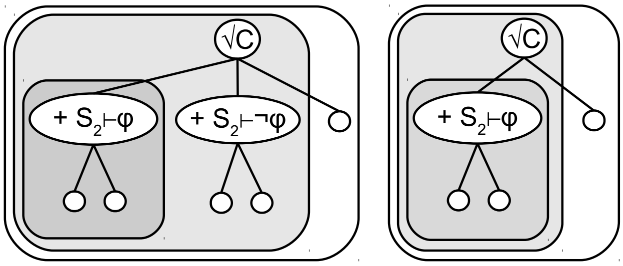


Figure 19: Response *yes* after bipolar (left) and monopolar (right) question.

(57) Congruent answer *no*:

a. To bipolar question:
(55) + $[\![no_\varphi]\!]^{\mathrm{S2,S1}}$
= (55) + $\mathrm{S_2}{\vdash}\neg\varphi$, a legal move.

b. To monopolar question:
(54) + REJECT$^{\mathrm{S2,S1}}$ + $[\![no_\varphi]\!]^{\mathrm{S2,S1}}$
= (54) + REJECT + $\mathrm{S_2}{\vdash}\neg\varphi$.

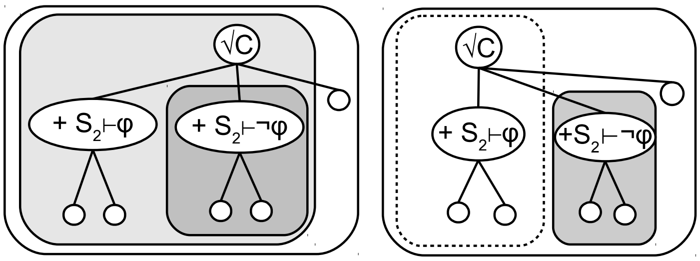


Figure 20:
Response no after bipolar (left) and monopolar (right) question

This captures the bias of monopolar questions: For them, the agreeing answer yes is a congruent answer, but the answer no requires a REJECT operation, and hence a more complex move. Hence the speaker can express a tendency towards one answer for strategic purposes. I consider this an advantage over alternative attempts to characterize biased polar questions. For example, Roelofsen & Farkas (to appear) have to assume a separate "highlighting" of one of the two alternative propositions that is extraneous to the underlying framework of inquisitive semantics. Reese (2007) treats biased questions as a combination of a question and an assertion, using a speech act combination operator, the dot operator, within Segmented Discourse Representation Theory. Within the current theory, no such combination is necessary.

It should also be pointed out that the current proposals breaks with the usual representation of questions within the propositional theories of questions (for a comparison with others, cf. Krifka 2011). For these theories, it is the essence of questions (in contrast to propositions) that they provide for two or more alternative propositions. For example, for Inquisitive Semantics (cf. Ciardelli e.a. 2013), questions are generated by a disjunction operator, which by necessity coordinates two or more meanings. In the current framework, monopolar questions are a simple extension (or rather, reduction) of bipolar questions, and still do not coincide with assertions.

It should be noted that the representation developed here extends to **alternative questions** in a straightforward way. They are derived just like polar questions by applying the ? operator to a *whether* question radical. They result in a meaning similar to a constituent question with two or more projected assertions, depending on the number of alternatives.

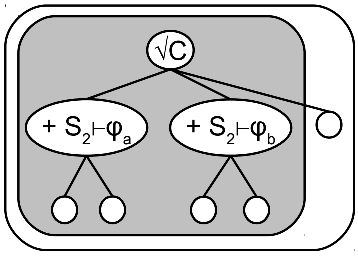


Figure 21: Alternative question

(58) ⟨..., C⟩ + ⟦[$_{\text{ForceP}}$ [[$_{\text{Force0}}$?-*did*] [$_{\text{CP}}$ ~~*whether*~~ [$_{\text{TP}}$ *Ed met* [[t$_{\text{wh}}$ [*Ann*]] *or* [t$_{\text{wh}}$ [*Beth*]]]]]]]⟧^{S1,S2}
$= \langle ..., C, \{\surd C\} \cup \bigcup\{C + S_2 \vdash p \mid p \in [\![[_{CP} \dots]]\!]^{S1,S2}\}\rangle$
$= \langle ..., C, \{\surd C\} \cup \bigcup\{C + S_2 \vdash p \mid p \in \{\lambda i[\text{Ed met Ann in i}], \lambda i[\text{Ed met Beth in i}]\}\rangle$

In case the of an alternative question that has TP alternatives, with the second alternative the anaphoric *or not*, we end up with a bipolar question.

(59) ⟨..., C⟩ + ⟦[$_{\text{ForceP}}$ ~~*whether*~~ [[$_{\text{Force°}}$?-*did*] [$_{\text{CP}}$ [$_{\text{CP}}$ t$_{\text{wh}}$ [$_{\text{TP}}$ *Ed* t$_{\text{did}}$ *meet Beth*]] *or* [$_{\text{CP}}$ t$_{\text{wh}}$ [$_{\text{TP}}$ *not* [$_{\text{TP}}$ ~~*Ed* t$_{\text{did}}$ *meet Beth*~~]]]]]]⟧^{S1,S2}
$= \langle ..., C, \{\surd C\} \cup \{C + S_2 \vdash \varphi_b, C + S_2 \vdash \neg\varphi_b\}\rangle$

Note that this forces a bipolar reading, in contrast to the question *Did Mary meet Beth?*, which we argued above to be ambiguous between a monopolar reading and a bipolar reading. There are also questions that enforce a monopolar reading. So called **declarative questions** (Gunlogson 2002) come with the syntax of an assertion clause, but they are interpreted as questions due to the prosody, which has a characteristic L+H% intonational phrase boundary tone.

(60) S_1, to S_2: *Ed met Beth?*

I propose to interpret this tone by an operator REQUEST that can take a speech act $\mathfrak{A}$ and turn it into a request to the addressee to perform that speech act. This is the interpretation of S_1 requesting a speech act from S_2. When A is an assertion, this will naturally turn into a monopolar question.

(61) $C +_{S1} \text{REQUEST}(\mathfrak{A}) = \{\surd C\} \cup C +_{S2} \mathfrak{A}$

###

8. Focus in Polarity Questions

(62) *Did Ed meet ANN*$_{\text{F}}$?
Was it ANN that Ed met?

Focus on the CP level for monopolar question:

(63) a. $[\![[_{CP}\ \textit{whether}\ [_{TP}\ \textit{Ed met BETH}_F]]]\!]$
$= \lambda i[\text{Ed met Ann in i}], = \{\varphi_b\}$
b. $[\![[_{CP}\ \textit{whether}\ [_{TP}\ \textit{Ed met BETH}_F]]]\!]_f$
$= \{\lambda i[\text{Ed met x in i}] \mid x \in \text{THING}\}, = \{\{\varphi_a\}\ \{\varphi_b\}, \{\varphi_c\}, \{\varphi_d\}\}$

Focus on the ForceP level for monopolar questions, represented as functions on C:

(64) a. $[\![[_{ForceP}\ \cancel{\textit{whether}}\ [[?\textit{-did}]\ [_{CP}\ t_{wh}\ [_{TP}\ \textit{Ed}\ t_{did}\ \textit{meet BETH}_F]]]]]\!]^{S1,S2}$
$= \lambda C[\{\surd C\} + S_2 \vdash \varphi_b + \varphi_b]$
b. $[\![[_{ForceP}\ \cancel{\textit{whether}}\ [[?\textit{-did}]\ [_{CP}\ t_{wh}\ [_{TP}\ \textit{Ed}\ t_{did}\ \textit{meet BETH}_F]]]]]\!]_f^{S1,S2}$
$= \{\lambda C[\{\surd C\} + S_2 \vdash \varphi_a + \varphi_a], \lambda C[\{\surd C\} + S_2 \vdash \varphi_b + \varphi_b],$
$\lambda C[\{\surd C\} + S_2 \vdash \varphi_c + \varphi_c], \lambda C[\{\surd C\} + S_2 \vdash \varphi_d + \varphi_d]\}$

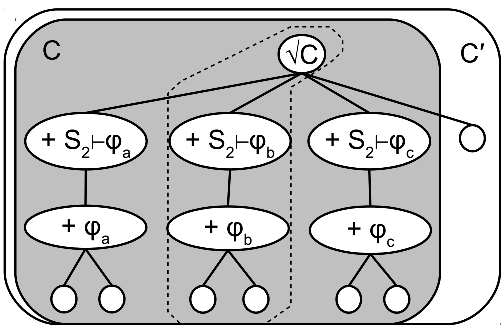
Application of question acts with alternatives, same condition as with assertions, cf. Error: Reference source not found:

(65) $\langle ..., C\rangle + [\![[_{ForceP}\ [?\ [_{CP}\ ...]]]]\!]^{S1,S2} = \langle ..., C, C + [\![[_{ForceP}\ [?\ [_{CP}\ ...]]]]\!]^{S1,S2}\rangle$,
provided that $C = \{\surd C\} \cup \bigcup\{C + A \mid A \in \mathfrak{A}_f\}$

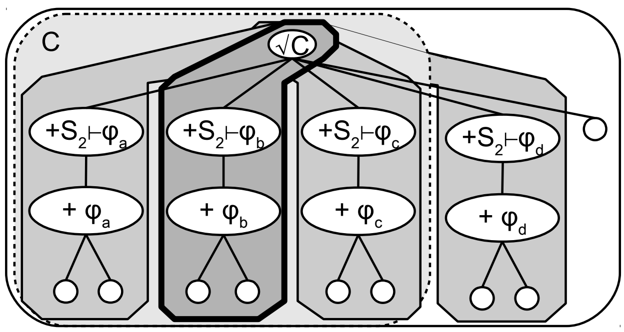
(66) $\langle ..., C\rangle + [\![[_{ForceP}\ \cancel{\textit{whether}}\ [[?\textit{-did}]\ [_{CP}\ t_{wh}\ [_{TP}\ \textit{Ed}\ t_{did}\ \textit{meet BETH}_F]]]]]\!]^{S1,S2}$
$= \langle ..., C, \{\surd C\} \cup \{C + S_2 \vdash \varphi_b + \varphi_b\}\rangle$,
provided that
$C = \{\surd C\} \cup \bigcup\{\{\surd C\} \cup \{C + S_2 \vdash \varphi_a + \varphi_a\}, \{\surd C\} \cup \{C + S_2 \vdash \varphi_b + \varphi_b\},$
$\{\surd C\} \cup \{C + S_2 \vdash \varphi_c + \varphi_c\}, \{\surd C\} \cup \{C + S_2 \vdash \varphi_d + \varphi_d\}\}$
$= \{\surd C\} \cup \{C + S_2 \vdash \varphi_a + \varphi_a, C + S_2 \vdash \varphi_b + \varphi_b, C + S_2 \vdash \varphi_c + \varphi_c, C + S_2 \vdash \varphi_d + \varphi_d\}$

Satisfied if C is restricted by the question *Who did Ed meet?* (can also be accommodated):

(67) a. $\langle ..., C'\rangle + [\![[_{ForceP}\ \textit{who did Ed meet}]]\!]^{S1,S2}$
$= \langle ..., C', \{\{\surd C'\} \cup C' + S_2 \vdash \varphi_a + \varphi_a \cup C' + S_2 \vdash \varphi_b + \varphi_b \cup C' + S_2 + \varphi_c + \varphi_c\}\rangle$
$= \langle ..., C', C\rangle$
b. $\langle ..., C', C\rangle + (64) = \langle ..., C', C, \{\surd C\} \cup C + S_2 \vdash \varphi_b + \varphi_b\rangle$,
provided that $C = \{\surd C\} \cup C + S_2 \vdash \varphi_a + \varphi_a \cup C + S_2 \vdash \varphi_b + \varphi_b \cup C + S_2 \vdash \varphi_c + \varphi_c\}$



CS after *Who did Ed meet?*



CS after *Did Ed meet BETH*$_F$*?*

(68) Answer *Yes* is congruent with respect to the monopolar question that was asked.

(69) Answer *No* (asserting $\lambda i\neg[\text{Ed met Beth in i}], = \neg\varphi_b$):

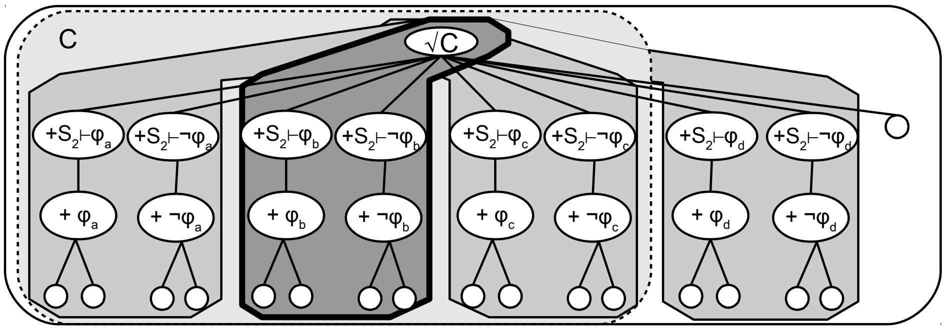
a. requires REJECT operation, leading back to commitment space C.
b. asserting $\neg\varphi_b$ is not an immediate legal move,
c. just as with excluding answers to wh-questions, cf. Error: Reference source not found:
– S_2 performs REJECT operation
– $S_2\vdash\neg\varphi_b$ and $\neg\varphi_b$ are added,
– Next legal moves are answers of the question *Who did Ed meet?*
– *S*imple answer *no* is felt incomplete, completion like *He met Ann* is expected.

Overall effect of polarity questions with focus: Biased constituent question, as in:

(70) *Who did Ed meet? Beth?*

Focus in bipolar questions or constituent questions is technically possible,
but there is no suitable linguistic form for creating an appropriate input commitment space C.

(71) S_1: *I want to know which persons Ed met yesterday. Did Ed meet BETH*$_F$ *yesterday?*
S_2: *No.*
S_1: *Did Ed met ANN*$_F$ *yesterday?*
But note that the question *Which persons did Ed meet yesterday?* is understood differently, rather as in (29)



9. Contrastive Topics in Questions

The other strategy for questions, including non-monopolar ones: Contrastive topic, L+H*:

(72) a. S_1: *I want to know who Ed and Dan met. Let's start. Who did ED*$_{L+H*}$ *meet* $_{H\%}$*?*
S_2: *ED*$_{L+H*}$ *met BETH*$_{H*}$ *, and DAN*$_{L+H*}$ *met ANN*$_{H*\ L\%}$.
b. S_1: *I want to know who met Beth. Let's start. Did ED*$_{L+H*}$ *meet Beth* $_{H\%}$*?*
S_2: *ED*$_{L+H*}$ *DID*$_{H*}$ *meet Beth, but DAN*$_{L+H*}$ *DIDn't*$_{H*\ L\%}$.

Contrastive topic (CT) as a strategy of answering complex questions (question under discussion, discourse trees, cf. van Kuppevelt 1995, Roberts 1996, Büring 2003).

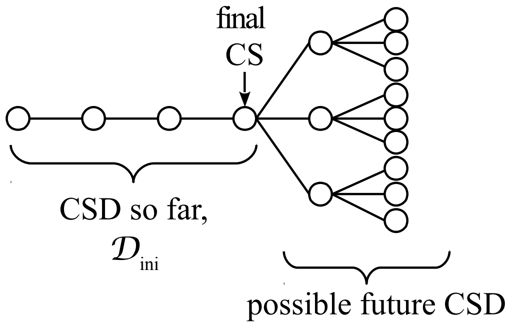
(73) S_1: *Who did Ed and Dan meet?*
S_2: *ED*$_{L+H*}$ *met BETH*$_{H*}$ *, and DAN*$_{L+H*}$ *met ANN*$_{H*\ L\%}$.

9.1 Interpreting CTs on the CSD level

- Contrastive topics have wide scope over illocutionary acts, indicating alternative acts (cf. Krifka 2001, Tomioka 2010 for contrastive topics interpreted on the speech act level).
- These alternative illocutionary acts are presupposed to be enacted in conversation, either before or after the current illocutionary act.
- Hence CTs express restrictions on the CSD, in particular on the possible continuations.
- Requires a notion of a **Commitment Space Development Space** (CSDS)

(74) a. A commitment space development space $\mathcal{D}$
is a set of CSDs that share an initial sequence, $\mathcal{D}_{ini}$

b. $\mathcal{D} + \mathfrak{A} = \{D \in \mathcal{D} \mid D$ starts with $[\mathcal{D}_{ini} + \mathfrak{A}]\}$



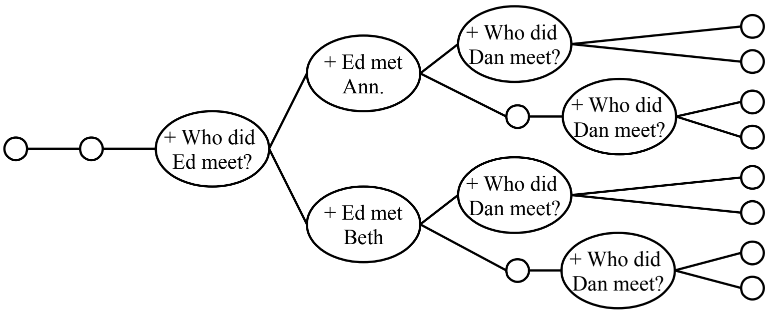
Syntax of illocutionary act with contrastive topic:

(75) a. $[_{CTP}$ $[_{CT}$ (as for) Ed] $[_{ForceP}$ *who did he meet*]]
b. $[_{CTP}$ [*Ed* $[_{ForceP}$ *who did* t_{Ed} *meet*]]]

(76) Interpretation of illocutionary act $\mathfrak{A}[d]$ with CT d:
$\mathcal{D} + \mathfrak{A}[d]$, as above
provided that there is a set of contextually given alternatives of d, ALT(d),
such that for all $D \in \mathcal{D}+\mathfrak{A}[d]$ and for all $x \in$ ALT(d) there is a C
such that $\langle C, C+\mathfrak{A}[x]\rangle$ is a part of D

Example, assuming that ALT(Ed) = {Ed, Dan}:

(77) $\mathcal{D} + [\![[_{CTP}\ \textit{Ed}\ [_{ForceP}\ \textit{who did}\ t_{Ed}\ \textit{meet}]]]\!]^{S1,S2} = \mathcal{D} + [\![[_{ForceP}\ \textit{who did}\ t_x\ \textit{meet}]]\!]^{S1,S2,x:Ed}$
provided that for all $D \in \mathcal{D} + [\![[_{ForceP}\ \textit{who did}\ t_x\ \textit{meet}]]\!]^{S1,S2,x:Ed}$ there is a C such that
$\langle C, C+[\![[_{ForceP}\ \textit{who did}\ t_x\ \textit{meet}]]\!]^{S1,S2,x:Ed}\rangle$ is a part of D, and
$\langle C, C+[\![[_{ForceP}\ \textit{who did}\ t_x\ \textit{meet}]]\!]^{S1,S2,x:Dan}\rangle$ is a part of D.



We assume that CTs are only defined for questions,
as e.g. *Ed*$_{CT}$ *met Beth*$_{F}$ does not presuppose that *Dan met Beth* was asserted.
Rather, *Ed*$_{CT}$ *met Beth*$_{F}$ presupposes the question *who did Ed*$_{CT}$ *meet*,
which in turn presupposes that the question *who did Dan meet* is asked as well.

Other uses of CSDS's:
Implicit questions evoked by a certain topic, e.g. talk about vacation,
cf. quaestio theory (Klein & von Stutterheim 1984), potential questions (Onea 2013).

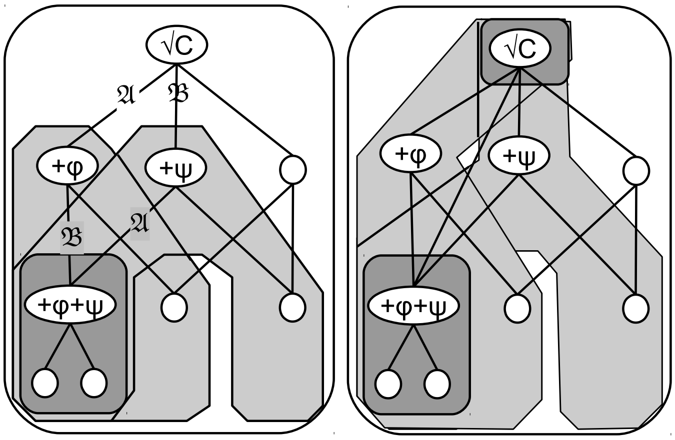
9.2 Interpreting CTs on the CS level

Assume that CTs presuppose a conjoined question (cf. Cohen & Krifka 2013 for speech act conjunction)

(78) *Who did Ed*$_{\text{CT}}$ *meet?*,
with ALT(Ed) = {Ed, Dan}
presupposes the **conjoined** question
Who did Ed meet, and who did Dan meet?

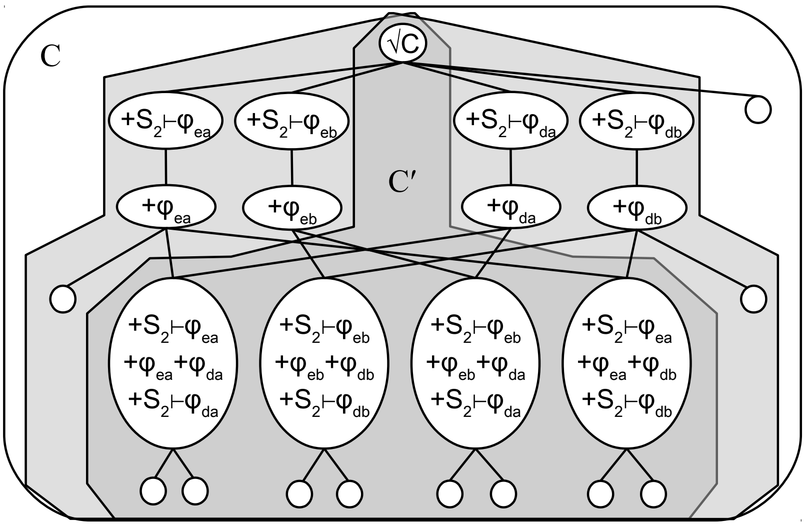
Conjunction of speech acts:

(79) C + [𝔄 & 𝔅] = [C + 𝔄] ∩ [C + 𝔅]
results in a rooted commitment space
for regular speech acts
and meta speech acts.

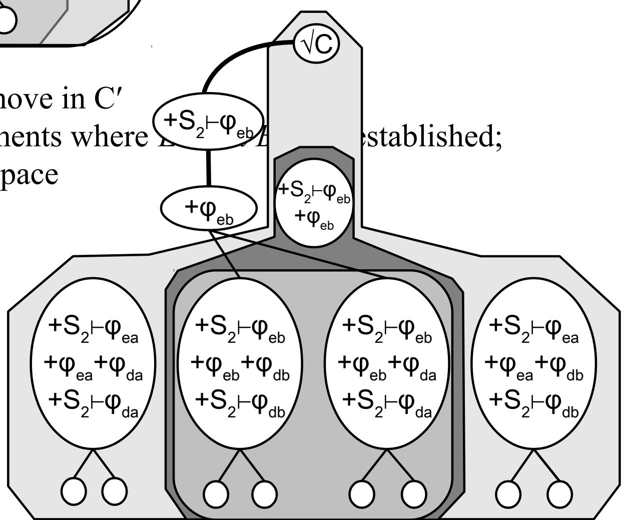


Conjunction of questions, assuming that wh-constituent restricted to {Ann, Beth}:

(80)
$$
\begin{aligned}
& \mathrm{C} + [\![[_{\text{ForceP}}\ \textit{who did Ed meet?}]]\!]^{\mathrm{S1,S2}}\ \&\ [\![[_{\text{ForceP}}\ \textit{who did Dan meet?}]]\!]^{\mathrm{S1,S2}} \\
= {} & [\mathrm{C} + [\![[_{\text{ForceP}}\ \textit{who did Ed meet?}]]\!]^{\mathrm{S1,S2}}] \cap [\mathrm{C} + [\![[_{\text{ForceP}}\ \textit{who did Dan meet?}]]\!]^{\mathrm{S1,S2}}] \\
= {} & [\{\surd\mathrm{C}\} \cup \bigcup\{c \subseteq \mathrm{C} \mid \surd\mathrm{C} + \mathrm{S}_2{\vdash}\varphi_{ea} + \varphi_{ea} \subseteq c\} \cup \{c \subseteq \mathrm{C} \mid \surd\mathrm{C} + \mathrm{S}_2{\vdash}\varphi_{eb} + \varphi_{eb} \subseteq c\}] \cap \\
& [\{\surd\mathrm{C}\} \cup \bigcup\{c \subseteq \mathrm{C} \mid \surd\mathrm{C} + \mathrm{S}_2{\vdash}\varphi_{da} + \varphi_{da} \subseteq c\} \cup \{c \subseteq \mathrm{C} \mid \surd\mathrm{C} + \mathrm{S}_2{\vdash}\varphi_{db} + \varphi_{db} \subseteq c\}] \\
= {} & \{\surd\mathrm{C}\} \cup \bigcup\{c \subseteq \mathrm{C} \mid \surd\mathrm{C} + \mathrm{S}_2{\vdash}\varphi_{ea} + \varphi_{ea} \subseteq c + \mathrm{S}_2{\vdash}\varphi_{da} + \varphi_{da} \subseteq c\} \\
& \cup \bigcup\{c \subseteq \mathrm{C} \mid \surd\mathrm{C} + \mathrm{S}_2{\vdash}\varphi_{ea} + \varphi_{ea} \subseteq c + \mathrm{S}_2{\vdash}\varphi_{db} + \varphi_{db} \subseteq c\} \\
& \cup \bigcup\{c \subseteq \mathrm{C} \mid \surd\mathrm{C} + \mathrm{S}_2{\vdash}\varphi_{eb} + \varphi_{eb} \subseteq c + \mathrm{S}_2{\vdash}\varphi_{da} + \varphi_{da} \subseteq c\} \\
& \cup \bigcup\{c \subseteq \mathrm{C} \mid \surd\mathrm{C} + \mathrm{S}_2{\vdash}\varphi_{eb} + \varphi_{eb} \subseteq c + \mathrm{S}_2{\vdash}\varphi_{db} + \varphi_{db} \subseteq c\} \\
= {} & \mathrm{C}'
\end{aligned}
$$



Assertion of *Ed met Beth* is not an immediate legal move in C′
but restricts the commitment space to those developments where … established;
requires re-rooting ∘ to create a rooted commitment space



(81) $C' + [\![[_{\text{ForceP}}\ \textit{Ed met Beth}]]\!]^{S2,S1}$
$= \circ\{c\in C' \mid \surd C' + S_2\vdash\varphi_{eb} + \varphi_{eb} \subseteq c\}$
$= \circ\{c\in C' \mid \cup\{\surd C' + S_2\vdash\varphi_{eb}+ \varphi_{eb} + S_2\vdash\varphi_{da} + \varphi_{da} \subseteq c\}$
$\quad \cup \cup\{\surd C + S_2\vdash\varphi_{eb}+ \varphi_{eb} + S_2\vdash\varphi_{db} + \varphi_{db} \subseteq c\}\}$
$= \circ\{c \in [C' + S_2\vdash\varphi_{eb} + \varphi_{eb}] \mid$
$[\surd[C' + S_2\vdash\varphi_{eb} + \varphi_{eb}] + S_2\vdash\varphi_{da} + \varphi_{da} \in c] \vee$
$[\surd[C' + S_2\vdash\varphi_{eb} + \varphi_{eb}] + S_2\vdash\varphi_{db} + \varphi_{db} \in c]\}$
$= C''$

Resulting C″: Question *Who did Dan meet?*,
which is congruently answered in the next move.

General rule for interpreting questions with CT:

(82) $\langle ..., C, C'\rangle + \mathfrak{A}[d] = \langle ..., C, C', C' + \mathfrak{A}[d]\rangle$,
provided that $C' = C + \underset{x\in ALT(d)}{\&} \mathfrak{A}[x]$

This holds for CT questions; CT assertions presuppose CT questions.

9.3 Interpreting CTs with a set of "backburner" questions

(83) Representation of illocutionary act and set of alternatives of illocutionary acts by a pair $\langle \mathfrak{Q}, \underline{\mathfrak{Q}}\rangle$.

(84) Performing a question with "backburner" questions:
$\langle ..., C\rangle + \langle \mathfrak{Q}, \underline{\mathfrak{Q}}\rangle = \langle ..., C, \langle C+\mathfrak{Q}, \underline{\mathfrak{Q}}\rangle\rangle$, where $C + \mathfrak{Q} = \mathfrak{Q}(C)$;
$\underline{\mathfrak{Q}}$ are the backburner questions that still have to be answered.

(85) Answering a question with alternatives
where $\underline{\mathfrak{Q}}–\mathfrak{Q} = \underline{\mathfrak{Q}} — \{\mathfrak{Q}\}$, provided that $\mathfrak{Q}\in\underline{\mathfrak{Q}}$, else undefined:
$\langle ..., \langle C+\mathfrak{Q}, \underline{\mathfrak{Q}}\rangle\rangle + \mathfrak{A} = \langle ..., \langle C+\mathfrak{Q}, \underline{\mathfrak{Q}}\rangle, \langle C+\mathfrak{Q}+\mathfrak{A}, \underline{\mathfrak{Q}}–\mathfrak{Q}\rangle\rangle$, **removal** of $\mathfrak{Q}$ from $\underline{\mathfrak{Q}}$

(86) Answering remaining questions: $\langle ..., \langle C, \underline{\mathfrak{Q}}\rangle\rangle + \mathfrak{A}$:
a. first attempt to find a $\mathfrak{Q}^*\in\underline{\mathfrak{Q}}$, then interpret as $\langle ..., \langle C+\mathfrak{Q}^*, \underline{\mathfrak{Q}}\rangle\rangle + \mathfrak{A}$
b. if not possible because $\mathfrak{A}$ is not a suitable answer, interpret as $\langle ..., \langle C+\mathfrak{A}, \underline{\mathfrak{Q}}\rangle\rangle$

(87) Generalization for backburner questions from different sources:
a. take $\langle ..., C\rangle$ as abbreviation of $\langle ..., \langle C, \emptyset\rangle\rangle$: no remaining backburner questions
b. have $\langle ..., \langle C, \underline{\mathfrak{Q}'}\rangle\rangle + \langle \mathfrak{Q}, \underline{\mathfrak{Q}}\rangle\rangle = \langle ..., \langle C, \underline{\mathfrak{Q}'}\rangle, \langle C+\mathfrak{Q}, \underline{\mathfrak{Q}'} \cup \underline{\mathfrak{Q}}\rangle\rangle$: bb-questions added.

Backburner questions collected in non-ordered set. Do we need trees (Roberts 1996)?

10. Appendix: A simpler syntax/semantics mapping?

Before: TenseP → CP → ForceP   Alternative proposal: TT → CP, TP → ForceP

Advantage: No need for *whether* deletion; new view on constituent questions.

(88) a. $[_{\text{CP}}\ \textit{whether}\ [_{\text{TP}}\ \textit{Ed met Beth}]]$ (as before)
b. $[_{\text{ForceP}}\ [[_{\text{Force}^\circ}\ ?\text{-}\textit{did}]\ [_{\text{TP}}\ \textit{Ed}\ \text{t}_{\text{did}}\ \textit{meet Beth}]]]$ (not derived from CP)

(89) a. $[\![[_{\text{Force}^\circ}\ ?\ ]]\!]^{S1,S2} = \lambda p\ \lambda C[\{\surd C\} \cup \{C+S_2\vdash p+p\}]$ (a monopolar question)
b. $[\![?]\!]^{S1,S2}([\![[_{\text{TP}}\ \textit{Ed met Beth}]]\!]^{S1,S2}) = \lambda C[\{\surd C\} \cup C+S_2\vdash\varphi_b+\varphi_b]$

Speech act conjunction and disjunction (cf. Krifka 2001, Cohen & Krifka 2014):

(90) $C + [\mathfrak{A}\ \&\ \mathfrak{B}] = [C + \mathfrak{A}] \cap [C + \mathfrak{B}]$ (see above)

(91) $C + [\mathfrak{A}\ \text{or}\ \mathfrak{B}] = [C + \mathfrak{A}] \cup [C + \mathfrak{B}]$
Results in a rooted commitment space for meta-speech acts, not for regular speech acts.

Alternative questions by question disjunction:

(92) $[\![[[_{\text{ForceP}}?\text{-}\textit{did Ed meet Ann}]\ \textit{or}\ [_{\text{ForceP}}\ ?\text{-}\textit{did Ed meet Beth}]]]\!]^{S1,S2}$
$= [\![[_{\text{ForceP}}\ ?\text{-}\textit{did Ed meet Ann}]]\!]^{S1,S2} \cup [\![[_{\text{ForceP}}\ ?\text{-}\textit{did Ed meet Beth}]]\!]^{S1,S2}$
$= \lambda C[\{\surd C\} + S_2\vdash\varphi_a + \varphi_a] \cup \lambda C[\{\surd C\} + S_2\vdash\varphi_b + \varphi_b]$
$= \lambda C[[\{\surd C\} + S_2\vdash\varphi_a + \varphi_a] \cup [\{\surd C\} + S_2\vdash\varphi_b + \varphi_b]]$

Bipolar questions as alternative questions:

(93) $[\![[[_{\text{ForceP}}\ ?\text{-}\textit{did}\ [_{\text{TP}}\ \textit{Ed meet Beth}]]\ \textit{or}\ [_{\text{ForceP}}\ ?\ [_{\text{TP}}\ \textit{not}\ [_{\text{TP}}\ \cancel{\textit{Ed met Beth}}]]]]\!]^{S1,S2}$

Constituent questions by generalized disjunction, wh-constituent determines set of questions.

(94) $[\![[_{\text{ForceP}}\ \textit{who}\ [?\text{-}\textit{did}\ [_{\text{TP}}\ \textit{Ed meet}\ \text{t}_{\text{wh}}]]]]\!]^{S1,S2} = \bigcup_{x\in\text{PERSON}} [\![[[_{\text{Force}^\circ}\ ?]\ [_{\text{TP}}\ \textit{Ed meet}\ \text{t}_x]]]\!]^{S1,S2}$

$= \lambda C[\{\surd C\} + S_2\vdash\varphi_a + \varphi_a] \cup [\{\surd C\} + S_2\vdash\varphi_b + \varphi_b] \cup [\{\surd C\} + S_2\vdash\varphi_c + \varphi_c]]$
$= \lambda C[\{\surd C\} + S_2\vdash\varphi_a + \varphi_a] \cup [\{\surd C\} + S_2\vdash\varphi_b + \varphi_b] \cup [\{\surd C\} + S_2\vdash\varphi_c + \varphi_c]]$

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