Why?

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Abstract

Even casual dialogue contains instances of reasoning. A paradigmatic case is the usage of *Why*-questions that intuitively elicit a *reason* for something. We present a thorough analysis of *Why*-questions in dialogue from a rhetorical perspective. We specify the semantics of *Why*-questions, *i.e.*, we define what the space of acceptable answers is, how this acceptability is itself up for further negotiation, and discuss some context-sensitive aspects of bare *Why?*. We formalise our model in a type-theoretical framework.

1 Introduction

Participating in a dialogue requires the interlocutors to *reason* about certain propositions and circumstances. On one hand, interlocutors are generally expected to back up the assertions they make with arguments, should this be required. On the other hand, the notion of *relevance* of an utterance is linked to reasoning: a relevant utterance is made for a reason, *e.g.*, to provide or inquire about information pertinent to the purpose of the dialogue.

Such reasons are not always explicated by the interlocutors, but can be elicited by clarification questions (Jackson and Jacobs, 1980; Breitholtz, 2010; Schlöder and Fernández, 2015). The paradigmatic examples are *Why*-questions. We are interested in what constitutes the space of possible answers to such questions and how they are interpreted in a discourse. The following examples retrieved from the British National Corpus (BNC) (Burnard, 2000) exemplify the basic phenomenon.

(1) a. B: He's in hospital.
b. C: Why?
c. B: Because he's not very well
(BNC, file KBF, lines 3394–3396)

(2) a. G: Do you want mum to come to Argos with me tomorrow morning?
(three lines omitted)
b. R: Why are you asking me?
c. G: Cos you said you'd come to Argos with me. (BNC, file KC8, lines 191–196)

In (1), B makes an assertion and C asks for a reason that backs the truth of the proposition expressed in (1a); note that this need not entail that C is doubting the content of B's assertion. We contrast this with what is happening in (2). There, G asks a question and R inquires about G's reason for doing so. In both cases, the initial speaker then supplies a *reason* that is marked with the particle 'because'. Here, we use the concept 'reason' intuitively—only if we can *define* what makes a reason, we can define what makes an answer to a *Why*-question.

A first observation is that the arguments expressed by the first and third utterances in (1) and (2) are logically incomplete: they indicate that the third utterance *is* a reason for the first, but not what warrants the inference. In classical rhetoric, such arguments are called *enthymemes*. An enthymeme is an argument of the form 'p hence q' which requires the listener to supply one or more underpinning premises. It has been observed that enthymematic reasoning is widespread in natural dialogue, and has been linked to clarification and cognitive load management (Jackson and Jacobs, 1980; Breitholtz and Villing, 2008). Therefore, we will analyse different types of *Why*-questions in terms of enthymematic reasoning to find out what the correlation is between rhetorical structure and different types of *Why*-questions.

The paper is structured as follows: In the next section, we will give an overview of existing work in discourse modelling related to reasoning, *Why*-questions and enthymemes. Afterwards, in section 3 we will further elucidate the dynamics of enthymematic reasoning with natural dialogue ex-

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amples. We will describe a formal treatment of our analysis in section 4.

2 Reasoning in Dialogue

Many conversational phenomena like disagreement, misunderstanding, and clarification can be linked to enthymematic reasoning (Breitholtz, 2014a). Consider the example in (3).

(3) A: Let's walk along Walnut Street
It's shorter (cited from Walker (1996))

This excerpt is uttered in the context of two colleagues on their way to work, where several routes are possible. Speaker A suggests to take one of them and provides a reason supporting this. The two propositions convey an enthymeme: an argument that relies on generally recognised facts and notions regarding how it is acceptable to reason. Enthymemes consist of two parts, a premise and a conclusion, as in the case of our example:[1]

(4) It (Walnut Street) is shorter
$\therefore$ Let's walk along Walnut Street

In this case the speaker counts on the interlocutor being able to supply something that underpins (3). That is, something that warrants its interpretation as an argument while simultaneously validating it.

These kinds of underpinnings are often referred to as *topoi* in the literature on rhetoric and argumentation. Some topoi may be applied to various subjects, while others are specific to a particular subject. Ducrot (1980; 1988) and Anscombre (1995) talk about topoi as links between propositions that are necessary for the propositions to cohere in discourse. A topos that could be drawn upon to validate the argument in (3) could be something like *'if a route is shorter (than other options), choose that route'*.

We refer to the topoi that are available to an individual as that individual's *rhetorical resources*. On this view, speakers have access to a vast set of topoi which to a great extent mirrors the experiences they have had. Another important aspect of this view is that the topoi accessible to one individual do not constitute a monolithic logical system. In contrast to, for example, a representation of world knowledge, a set of topoi may contain contradictions or principles of inference which lead to contradictions.

[1]This distinguishes them from logical arguments or syllogisms which typically have *three* parts: A premise, a conclusion, and a rule sanctioning the inference.

These phenomena have also been discussed from the perspective of *discourse relations*; most notably in the SDRT framework (Asher and Lascarides, 2003). SDRT includes the discourse relations *Explanation*(α, β) and *Result*(β, α). These relations are assigned to α and β only if it is *true* in the underlying world model that β can be a cause for α. Because these inferences are done in a defeasible logic, SDRT can also account for the fact that sometimes β does not explain α in spite of 'β, hence α' being a valid form of inference.

SDRT also includes meta-discursive versions of these relations. These model the fact that sometimes speakers give reasons for *making* certain speech acts, as *e.g.*, in example (3) where the speaker gives a reason for making a suggestion. A relation particularly interesting to us is *Q-Elab*(α, β) that applies when β asks a question pertinent to the goal that the speaker of α wants to achieve by uttering α. To our understanding, *Why*-questions broadly fall under this umbrella, but no such account of *Why?* has yet been elaborated.

We prefer the rhetorical approach over the discourse relations model for the following reason. As our analysis will show, inference patterns are dynamic in that they can be presupposed, accommodated, elicited and themselves be discussed. The SDRT account, as far as we understand it, is not amenable to such flexibility. In particular, the semantics of *Q-Elab*(α, β) requires that the space of possible answers to β is fixed and known (Asher and Lascarides, 2003, Sec. 9.3.3). If β is a *Why*-question, we do not believe this to be the case. This is because the answer set to a *Why*-question depends on the available topoi. Since topoi are dynamic, so must be these answer sets.

An important consequence of this, as we see it, is that the acceptability of a given reason does not depend on an inferential relationship being *correct* (in some objective sense, *e.g.*, in a model), but merely on it being subjectively *acceptable* to the interlocutors. Acceptability, in turn, depends on the rhetorical resources of individual speakers.[2]

3 Analysing Reasons

We now describe how we model what counts as a *reason*, *i.e.*, what counts as an answer to a *Why*-

[2]This also means that our interest in *Why*-questions differs from analyses that seek to elucidate what *explanations* are in philosophy of science (Bromberger, 1992; van Fraassen, 1980). Our *reasons* are dialogical phenomena, whereas their *explanations* are, roughly, about natural or physical laws.

question. We then discuss by way of examples how these questions are used and answered in dialogue and how they contribute to grounding. Then, we summarise our findings and present some interesting cases that fall outside our analysis.

3.1 Reasons

Certainly, the answers given by B and G in our initial examples (1) and (2) are not arbitrary. Not *any* utterance would be an acceptable answer to the *Why*-questions in these examples. Similarly, not every utterance that expresses 'p because q' is immediately acceptable to its addressee. We stipulate that q is a *reason* for p if there is a topos that validates the enthymeme $q \therefore p$. Stating that 'p because q', 'if q, then p' or answering 'q' to 'Why p?' expresses that q is a reason for p. Hence, such utterances presuppose that there is such a topos. Thus, addressees can either retrieve an appropriate topos from their set of rhetorical resources or infer and accommodate a new one.

The following examples provide evidence for this conception.

(5) a. J: I roasted it and we couldn't eat it on the Sunday and
b. A: Could not? Why could you not eat it?
c. J: That was bull beef.
d. A: Oh right.
e. H: our second class beef, you see.
f. J: Then I, I put it in a saucepan and I stewed it the next day
(BNC, file K65, lines 284–299; some backchannel utterances omitted)

In (5c), J gives an answer to a *Why*-question, *i.e.*, J gives what she construes to be a reason for *'being unable to eat the roast'*. Speaker A indicates that he accepts this as an answer, but H still elaborates in (5e). The addtional information in (5e,f) suggests the following enthymeme:

(6) x is bull beef
$\therefore$ J could not eat roasted x
Topos: *one cannot roast bull beef (but ought to stew it)*

This dialogue offers evidence for our claim that what *makes* (5c) an answer to (5b) is the more general statement indicated in (5e,f), *i.e.*, the topos of (6). To an interlocutor that is unaware of this information, answering (5c) to (5b) would seem like a *non sequitur*. The following example is an explicit case in point. The second speaker explicitly mentions the principle that he takes to back the conditional statement in (7a).[3]

(7) a. D: I'm self-funding my campaign, I tell the truth.
b. J: 'I'm rich, therefore I tell the truth' has [...] no cause and effect between the two.
(from *Last Week Tonight*, Feb. 29th, 2016)

The explication of the topos in (7b) suggests to us that J has interpreted D's utterance as (8).[4]

(8) D self-funds his campaign
$\therefore$ D tells the truth
Topos: *rich people tell the truth*

3.2 Contextual dependence of *Why*-questions

Based on this definition of what makes a reason, we now look into the context of *Why*-questions. We propose that the reasons elicited by these questions are dependent on (i) the current issue under discussion and (ii) the form of the question itself, *i.e.*, its sentential or non-sentential character. The elicited reasons can be either factive ('why p?', given some proposition p under discussion) or meta-discursive ('why are you saying p / asking q / suggesting r?', given some salient dialogue act).[5] While any type of reason can be queried with a sentential *Why*-question, only a restricted set of possible reasons can be elicited by bare *Why?*.

3.2.1 Factive reasons

In contexts where the current issue under discussion has arisen from an asserted proposition, *Why*-questions typically ask for a reason justifying the asserted content. For instance, example (5b) is a sentential form of such a *factive Why*-question and example (1b) from the Introduction is a bare factive *Why?*. We consider the following to be an appropriate reading of (1a,c).

[3] This example is from the TV show *Last Week Tonight*. (7a) is an excerpt from a speech by Donald Trump; (7b) is John Oliver's commentary.

[4] Though (8) is not the *only* possible interpretation of (7a).

[5] We call *Why*-questions 'factive' if they inquire about a *claim* and contrast them with those inquiring about an *act*. We do not claim that such questions are factive in the sense of factive verbs like *know*. One can pose a factive *Why*-question without presupposing the truth of the claim, *e.g.*, *'Why would this be true?'*. Some prior work, *e.g.*, Hempel (1965) or Hintikka and Halonen (1995), claims that a *Why*-question carries its core proposition as a presupposition (sometimes, *e.g.*, Bromberger (1992), with the restriction that the content is in indicative mood, excluding '*Why would...*' cases). The observations we make seem to cast doubt on this. Apparently, one can ask '*Why* p?' without accepting p. An example is (25) below; see our discussion there.

(9) x is not very well
$\therefore$ x is in the hospital
Topos: *unwell people go to the hospital*

An interesting special case arises when the issue under discussion stems from a conditional statement. Then, *Why?* elicits a backing for an already stated premise–conclusion pair (*i.e.*, it elicits a reason for the enthymeme *itself*). Simply put, asking for the grounds of a conditional statement elicits an underpinning premise, but the application of this premise is *itself* enthymematic.

(10) a. D: If you feel cold you'd be dead.
b. C: Why?
c. D: You just are. Part of you being alive is that you're warm.
(BNC, file KBW, lines 11065–11068)

The utterance (10a) states an inferential relationship without giving grounds for the relationship. The *Why?* in (10b) asks for a reason for this relationship, *i.e.*, for the premise in (11).

(11) –
$\therefore$ (x is cold $\therefore$ x is dead)

Put differently, (10b) asks for a reason why *x is cold* is a reason for *x is dead*. Thus, we represent the content of (10a) as the enthymeme in (12) and (10b) as asking about the *topos* of (12).

(12) x is cold
$\therefore$ x is dead
Topos: –

Then, the utterance (10c) supplies such a topos, so the *nested* enthymeme in (13) is a representation of what is under discussion after (10c).

(13) Living things are warm.
$\therefore$ x is cold
$\therefore$ x is dead
Topos: *contraposition*.

This in particular serves to illustrate the fact that enthymemes can be nested: In principle, this situation would now license the elicitation of a backing to support the enthymeme in (13) again (and so on). Already Lewis Carroll (1895) observed that one can always ask for what licenses an inference, then ask for what licenses the license *etc. ad infinitum*. Therefore, an adequate model needs to *always* assume that there is a topos in the context that the interlocutors do not explicate, but implicitly accommodate. The difference between (12) and (13) is that the topos implicit in (12) is explicated in (13)—but the explication again presupposes a new implicit inference pattern.

Similarly, in the next example, the asker of the *Why*-question is *not* able to accommodate the answer as a reason. So he questions the relevance of the answer with *So what?* (we will further discuss *So what?* in the next subsection).

(14) a. P: I was with Nanna and Adrian.
b. R: No Daddy said you should be with Michelle and Mutty.
c. P: ⟨unclear⟩⟨pause⟩ Why do I ⟨unclear⟩ Nan and Adrian?
d. R: Well cos ⟨pause⟩ erm some of the questions are sort of, English questions.
e. P: So what?
f. R: Well Michelle's not English.
(BNC, file,KD0, lines 3624–3629)

The dialogue (14) is about assigning groups in some (not further specified) game. In (14e), speaker P indicates that he does not see what makes (14d) an answer to (14c). Then, in (14f), R supplies an additional premise that supports the following nested enthymeme.

(15) Michelle is not English
$\therefore$ there are some English questions
$\therefore$ P should be with Michelle and Mutty
Topos: *Non-English people need help with English questions*

The enthymeme in (15) particularly exemplifies the notion described above: Once elicited, a backing becomes a premise in a superordinate enthymeme that again requires an implicit topos to be interpreted.

3.2.2 Meta-discursive reasons

The utterance (2b) in the Introduction is an example of a *Why*-question asking for a reason justifying a *linguistic* fact. Such a meta-discursive interpretation is the only one available to bare *Why?* when the active issue under discussion does not stem from asserted content. In example (16) the active issue is a question and in (18) it is a suggestion.[6] Here, rather than prompting a reason to justify a contextually provided proposition, the *Why?*'s can be glossed as *'Why are you saying this?'*. The answers in (16b) and (18b) raise the enthymemes in (17) and (19), respectively.

[6](16) is between a child (A) and its minder (B). A wants something, and B is wise to A's attempt at manipulation.

(16) a. A: Do you love me ⟨unclear⟩?
b. B: Why?
c. A: ⟨unclear⟩ I love you so much.
(BNC, file KCM, lines 1057–1060)

(17) A loves B
∴ A wants to know if B loves A
Topos: *one wants to know if love is requited*

(18) a. D: Oh I should keep the strawberries if I were you.
b. C: Why?
c. D: Strawberries are delicious.
(BNC, file KBW, lines 9848–9850)

(19) D thinks strawberries are delicious
∴ D suggests to keep strawberries
Topos: *one should keep delicious things.*

When replying to assertions, bare *Why?* does not have this effect, as it is interpreted to ask for a reason for the asserted proposition being factual, as in (9). Instead, a sentential *Why*-question is needed to elicit a meta-discursive reason, *e.g.*, *'Why are you telling me this?'*. Interestingly, meta-discursive reasons can be queried in these cases with non-sentential *So (what)?*, as exemplified below:

(20) a. C: Who are you going to snog on Saturday? (two lines omitted)
b. K: I don't know.
c. C: Snog Phil.
d. K: No I've done him already ⟨laugh⟩.
e. C: So?
f. K: done it, been there, got the T-shirt.
(BNC, file KPH, lines 1582–1588)

In (20e), C questions the relevance of *'having done him already'* to the issue of *'not snogging Phil'*. We model this as the enthymeme in (21): C recognises that K is giving a reason for her rejection of the proposal in (20c), but cannot supply or infer a topos to validate the inference. The topos K supplies (by conventional implicature) in (20f) seems to be *'repeated experiences are boring'*.[7]

(21) K has snogged Phil already
∴ K will not snog Phil
Topos: –

[7] A variety of online dictionaries (Urban Dictionary, Wiktionary, and The Free Dictionary) agree that *'been there, done that, got the T-shirt'* conventionally means that the speaker is familiar with an activity to the point of boredom.

A *Why?* in place of (20e) would ask for a reason why K has already snogged Phil, *i.e.*, it would ask for the missing premise in (22) (like in 1b).

(22) –
∴ K has snogged Phil already

So (what)? is meta-discursive in particular when replying to an answer to an earlier question. That is, asking *'Why are you saying this?'* of an answer is asking *'How does this answer my question?'*. This explains the function of *'So what?'* in (14).

3.3 Reasons and grounding

As mentioned before, sometimes *Why*-questions function as clarification questions. We draw the conclusion that the dynamics of reasons we just discussed can be related to the grounding process. We begin by observing that sometimes the rejection of a premise in an enthymeme can leave the *conclusion* ungrounded, *i.e.*, not mutually accepted by the interlocutors. The dialogue in (23) is a case in point.

(23) a. M: You're not having bacon till Monday. ⟨pause⟩ (three lines omitted)
b. M: You're working, so you don't need bacon.
c. J: I'm not working Monday.
d. M: Well you can go and get it.
(BNC, file KCL, lines 405–411)

Here, M makes a proposal in (23a) and backs it with the enthymeme (24) in (23b).[8] J in (23c) denies the premise of (24). M in (23d) concedes that therefore the conclusion (23a) is defeated.

(24) J is working on Monday
∴ J does not need bacon on Monday

Also, loosely following the distinction between *intention recognition* and *intention adoption* of Schlöder and Fernández (2015), we observe that one can *recognise* a topos that validates an enthymeme without *accepting* the topos as valid (*i.e.*, without adopting the topos in one's private set of available topoi). This is shown in example (7), where J cites a topos that would support the enthymeme, but denies that it is valid.

With these preliminaries in place, we can consider an example where a *Why?* is asked before accepting an assertion.

[8] The topos licensing the enthymeme is not clear to us.

(25) a. C: Got the junior tap and the senior tap.
b. B: Yeah but you'll get that next year again.
c. C: Why?
d. B: Because you got honours didn't you? In grade three. ⟨pause⟩
e. C: No cos junior tap was for grade three.
f. B: Have you done grade four tap?
(BNC, file KBF, lines 12258–12264)

We analyse this as follows. B makes an assertion in (25b) that is not immediately acceptable to C, so she asks for a reason in (25c). B supplies a reason in (25d), completing the enthymeme in (26).

(26) C got grade three honors
$\therefore$ C will get junior and senior tap

Then, in (25e), C denies that this is a valid inference. Apparently B concedes this: instead of arguing the point of (26) she is looking for a *different* premise that would allow her to infer the conclusion of (26). This evinces that the proposition asserted in (25b) is still not accepted by C, *i.e.*, it is left ungrounded.

3.4 Summary of findings

Based on the evidence analysed in the preceding subsections, we summarise our findings on the dialogue dynamics of *Why*-questions as follows. We also include the question *So (what)?*, which, as we have seen, serves to elicit reasons not available to bare *Why?*. Our (informal) model goes like this:

(i) *Why*-questions, including bare *Why?*, can have factive and meta-discursive readings.

(ii) The availability of these readings depends on context. In the case of a propositional antecedent, the meta-discursive reading is not immediately available to bare *Why?*, but it can instead be obtained with *So (what)?*

(iii) A *reason*, *i.e.*, an acceptable answer to a *Why*-question, is a proposition that connects enthymematically to the question's antecedent.

(iv) In interpreting such an answer, the listener can either apply an available topos, accommodate the presupposition that there *is* such a topos, or elicit another tacit premise. The last case can again be modelled as asking for a *reason* for why the enthymeme *itself* is valid.

(v) To understand an enthymeme—or that something is given as a reason—it is not required to consider the underpinning topos valid.

3.5 Special cases

Our main interest in this paper is the elicitation, interpretation, and accommodation of *reasons* as a dialogical phenomenon. We note that while the interpretation of bare *Why?* is of interest to us, we cannot claim to model the phenomenon exhaustively. A particularly striking example is Ginzburg's much discussed *turn-taking puzzle* (Ginzburg, 2012, Ex. 23, here as 27).

(27) A: Which members of the audience own a parakeet?
a. A: Why? [Why own a parakeet?]
b. B: Why? [Why are you asking?]
c. A: Why am I asking this question?

Our account of what it means to give a reason, *i.e.*, to answer a *Why*-question, straightforwardly accounts for all three cases in (27), but our informal discussion of bare *Why?* only accounts for (27b). As (27c) shows, the meta-discursive reading is available in the context of (27a), but, still, the bare *Why?* there has a factive reading. Modelling these differences would require a more sophisticated analysis of what is under discussion than we can provide here.

We used SCoRE (Purver, 2001) to systematically search for further counterexamples.[9] The following two examples show further functions of *Why* that our analysis does not cover.

(28) a. D: You know why they can't put more carriages on a train?
b. G: Why? (BNC, file KCA, lines 1912–1913)

(29) a. U: Andy, do you want a cup of tea?
b. A: Er er, yeah. Cheers.
c. M: Do you want one Nick?
d. N: Why not? (BNC, file KPR, lines 95–99)

The *Why?* of (28b) is a reprise fragment of its antecedent and cannot be glossed as *'Why are you asking?'*. This example indicates to us that the interpretation of bare *Why?* is at least sometimes elliptical. An elliptical account of *Why?* would also serve to disentangle the turn-taking puzzle (27). Such an account would be complementary to our discussion in that it would help to determine the proposition that a *Why*-question is about.[10] From

[9] According to our search, the dialogue section of the BNC contains 2256 *Why*-questions, 858 (38%) of these bare *Why?*. We manually surveyed a random selection of about 200.

[10] It seems possible that a grammar for elliptical *Why?* can also consider *'are you asking?'* as elliptical content and thereby predict meta-discursive readings as well. It seems unlikely, however, that *'so (what)?'* is elliptical (we thank an anonymous reviewer for pointing this out to us).

that point onward, our account of what makes a reason would apply. In addition, the antecedent (28a) is also an *embedded Why*-question that does not prompt G to provide a reason. Here, we need to leave the embedding behaviour of *Why*-questions, elliptical interpretations and the relation to reprise fragments to further work.

In (29d), the speaker N seems to use *Why not?* to indicate that he would like some tea, *i.e.*, as an agreement move.[11] We believe that this function of *Why not?* is related to the function of *Why?* as a clarification question (see subsection 3.3). In the account of clarifying *Why?* of Schlöder and Fernández (2014), an addressee is assumed to accept a proposal if they have no reason not to. Hence, we interpret *Why not?* in contexts like (29) to mean that the speaker cannot think of a reason not to. Thereby, it implicates acceptance. A strikingly explicit example for this is (30).

(30) A: Do you agree with that?
G: I have no reason to disagree. Yes.
(BNC, file FMN, lines 492–493)

We note however that *Why not?* also can have the factive function we discussed in subsection 3.2.1 as long as its antecedent has negative polarity. Example (31) is a typical case.

(31) T: I'm not going to sleep.
C: Why not? (BNC, file KBH, lines 4408–4409)

4 Formal Modelling

In this section we will use a Dialogue Game Board (DGB) semantics cast in Type Theory with Records (TTR) to formalise the notions discussed in the previous section. We will take as our point of departure the model for analysing rhetorical reasoning in dialogue developed by Breitholtz (2014a). This account of enthymematic reasoning builds on the formal work on dialogue modelling by Cooper and Ginzburg (2012; 2015). The leading idea of this approach is that a theory of dialogue should be cognitively plausible as well as computationally feasible. TTR is put forward as a framework that is just that.[12] We intend to show that our observations are structured and precise enough to be embedded in such a framework and be integrated in a well-developed dialogue semantics. Since the rhetorical model we employ makes frequent reference to both cognition and computation, *e.g.*, when it comes down to the availabilty and retrieval of certain topoi by individual interlocutors, the TTR framework seems appropriate.[13]

The semantics of Cooper and Ginzburg models the information states ('game boards') of individual speakers and their changes as the dialogue progresses. A full dialogue semantics, *e.g.*, KoS (Ginzburg, 2012), might make use of a large set of features in these information states. Here we will only explicitly mention a minimal subset that is sufficient to model enthymematic reasoning. A gameboard is modelled as a *record type*, *i.e.*, a structured type featuring multiple labelled fields of certain types; '$\mathrm{l} : T$' expresses that whatever is associated with label 'l' ought to be of type T (Cooper, 2005). A DGB has two major fields called 'shared' and 'private'. Shared information is information which is in some way necessary for a dialogue contribution to be interpreted in a relevant way. This includes 'moves', the list of *moves* in the dialogue, , 'l-m', the *Latest Move*, and 'qud', the *questions under discussion*.

Breitholtz (2014a) adds two addtional 'shared' fields: 'eud', *enthymemes under discussion* and 'topoi', a *list of topoi* required to interpret the dialogue. An enthymeme being *under discussion* on a speaker's game board means that this speaker acknowledges the enthymeme to be an argument put forward in relation to some issue raised in the dialogue. There may be several enthymemes simultaneously under discussion. Note that recognising an enthymeme as being under discussion is not the same as accepting it as valid.[14] Arguably, speakers are aware of many topoi, some of which they do not agree with, and use them to recognise rhetorical structure.[15]

Finally, the field 'private' contains information private to one interlocutor; this includes an 'agenda' and another field 'topoi' that records the

[11] Similarly, questions like *'Why don't you come in?'* are conventionally read as suggestions: the space of possible answers includes *'Thank you'*. However, if the suggestion is *not* followed, the literal Why-question can be answered by giving a reason, *e.g.*, *'I don't want to impose.'*

[12] One particular advantage attributed to TTR is that it allows one to model natural language without appealing to (sets of) possible worlds. Possible world models are criticised for having both cognitive and computational problems; see for example Ranta (1994) or Chatzikyriakidis and Luo (2014).

[13] It is noteworthy, however, that the model we apply bears a strong connection to rather more conventional logics of default inference (Breitholtz, 2014b).

[14] In most cases we discuss here, recognising a pair of utterances as forming an enthymeme is a given, as they are rhetorically connected by a *Why*-question.

[15] Breitholtz mentions political examples like *we love freedom – we are against taxes* that can be recognised even by people who do not support the argument themselves.

rhetorical resources, *i.e.*, the topoi acceptable to this particular interlocutor. The record type (38) in the next subsection is an example for a DGB.

Now we can formalise enthymemes and topoi. Following Breitholtz (2014a), we model enthymemes and topoi in the same way: as functions from *situations* to *situation types*. An enthymeme $A \therefore B$ expresses that in a situation satisfying A, B holds, *i.e.*, if s is an A-situation, then s is also a B-situation. Hence, the enthymeme can be represented as a mapping of situations in which A holds to a type corresponding to B. If such a function can be computed from an available topos, then the enthymeme is acceptable. Thus we also represent topoi as such functions and say that a topos licenses an enthymeme if from the function representing the topos we can compute the function representing the enthymeme. In the typical case of a topos being a general principle, this computation would be to *restrict* the topos to the situations in which the enthymeme is supposed to apply.

Note in particular that this means that the formal representation of enthymemes and topoi is the same: functions on situations of certain types. The difference between the two concepts lies in their dialogue dynamics: an enthymeme under discussion *claims* that there is such a function and an available topos says that there, in fact, *is* one.

4.1 A formal account of reasons

In section 3.1 we stipulated that q is a reason for p if there is a topos that validates $q \therefore p$. The examples there also show that what is taken by one dialogue participant as an acceptable validation of an argument may be unacceptable—even unrecognisable—to another. Consider the example in (7), where J points to a topos that seems to be a possible backing for the enthymeme conveyed by D's utterance—and then rejects the enthymeme. Let us consider the enthymeme conveyed by D in *'I'm self-funding my campaign, I tell the truth'*, here formalised as $\mathcal{E}_1$ in (32).

(32) $$\mathcal{E}_1 = \lambda r{:}\begin{bmatrix} x = \mathrm{SELF} : \mathit{Ind} \\ c_{\mathit{self_fund}} : \mathrm{self_fund(x)} \end{bmatrix}.\left[c_{\mathit{truth}} : \mathrm{tell_truth(r.x)}\right]$$

J points out that he considers *'rich people tell the truth'* to be the topos that underpins D's statement. We formalise this as the topos $\mathcal{T}_1$ in (33).

(33) $$\mathcal{T}_1 = \lambda r{:}\begin{bmatrix} \mathrm{x} : \mathit{Ind} \\ \mathrm{c}_{\mathit{rich}} : \mathrm{rich(x)} \end{bmatrix}.\left[c_{\mathit{truth}} : \mathrm{tell_truth(r.x)}\right]$$

Now, to see that (33) justifies (32), we need to derive the function $\mathcal{E}_1$ from the function $\mathcal{T}_1$. First, as we discussed, the application of a topos can require further tacit premises and topoi. Here, it seems reasonable to assume that J counts *someone who self-funds their campaign is rich* among his rhetorical resources. This is the topos $\mathcal{T}_2$ in (34).

(34) $$\mathcal{T}_2 = \lambda r{:}\begin{bmatrix} \mathrm{x} : \mathit{Ind} \\ \mathrm{c}_{\mathit{self\text{-}fund}} : \mathrm{self_fund(x)} \end{bmatrix}.\left[c_{\mathit{rich}} : \mathrm{rich(r.x)}\right]$$

Intuitively, to justify (32), one needs to apply (34) and (33) in succession. That is, we can compute $\mathcal{E}_1$ by composing $\mathcal{T}_1 \circ \mathcal{T}_2$ and instantiating the individual x as the person D. Note, however, that $\mathcal{T}_1$ is probably not acceptable to most people, and it also seems likely that D had a different topos in mind for underpinning his statement.

4.2 Factive reasons

Let us return to example (1), repeated here as (35).

(35) a. B: He's in hospital.
b. C: Why?
c. B: Because he's not very well

After B uttered (35a), C and B updated the latest move 'l-m' on their DGBs to include the claim that X *is in the hospital*, where X is the anaphoric resolution of 'he'. In uttering *Why?*, C inquires about the reason why this is the case. To answer, B searches her rhetorical resources for a topos that can underpin an inference $\varphi \therefore \psi$ satisfying these properties: ψ can be used to conclude that someone is in the hospital, and φ applies to X in this context. Such a topos has the form of $\mathcal{T}_1$ in (36).

(36) $$\mathcal{T}_1 = \lambda r{:}\begin{bmatrix} \mathrm{x} : \mathit{Ind} \\ \mathrm{c}_{\mathit{unwell}} : \mathrm{unwell(x)} \end{bmatrix}.\left[\mathrm{c}_{\mathit{hospital}} : \mathrm{in_hospital(r.x)}\right]$$

This is, intuitively, a generally acceptable pattern of inference. So it is plausible that B can retrieve $\mathcal{T}_1$ from her rhetorical resources. Informed by this topos, B then utters (35c), expressing the enthymeme in (37).

(37) $$\mathcal{E}_1 = \lambda r{:}\begin{bmatrix} \mathrm{x} = \mathrm{X} : \mathit{Ind} \\ \mathrm{c}_{\mathit{male}} : \mathrm{male(x)} \\ \mathrm{c}_{\mathit{unwell}} : \mathrm{unwell(x)} \end{bmatrix}.\left[\mathrm{c}_{\mathit{hospital}} : \mathrm{in_hospital(r.x)}\right]$$

Now, the other speaker C, upon interpreting (35c), updates his game board to include $\mathcal{E}_1$ as the *enthymeme under discussion* ('eud'), as seen on C's game board in (38).

(38) $$\mathrm{DGB}_C = \begin{bmatrix} \mathrm{private} : \begin{bmatrix} \mathrm{agenda} : \mathrm{list}(\mathit{RecType}) \\ \mathrm{topoi} : \mathrm{list}(\mathit{Rec} \rightarrow \mathit{RecType}) \end{bmatrix} \\ \mathrm{shared} : \begin{bmatrix} \mathrm{l\text{-}m} : \begin{bmatrix} \mathrm{e} : \mathrm{Assert(B,C)} \\ \mathrm{ctnt} : T_{\mathit{unwell}} \end{bmatrix} \\ \mathrm{qud} : \mathrm{list}(\mathit{Question}) \\ \mathrm{moves} : \mathrm{list}(\mathit{Illoc}) \\ \mathrm{eud} = [\mathcal{E}_1] : \mathrm{list}(\mathit{Rec} \rightarrow \mathit{RecType}) \\ \mathrm{topoi} : \mathrm{list}(\mathit{Rec} \rightarrow \mathit{RecType}) \end{bmatrix} \end{bmatrix}$$

Then, C searches his resources for a topos of which $\mathcal{E}_1$ is an instantiation. Let us assume here that he can retrieve the topos $\mathcal{T}_1$ as well. Note that the domain of $\mathcal{T}_1$ is a more general type than the domain of $\mathcal{E}_1$. Thus, $\mathcal{T}_1$ can be restricted to the function $\mathcal{E}_1$, underpinning the enthymeme in (37).

4.3 Meta-discursive reasons

We also observed that *Why*-questions can have *meta-discursive* readings, *i.e.*, asking for the justification of a *linguistic* fact. We model this as follows: factive *Why*-questions ask about the latest move's *content*, whereas meta-discursive questions ask about the move *itself*.

In a game board semantics, the contents of the DGB are modified via *update rules* that link the progression of the dialogue (as recorded in 'shared') to the interlocutors' beliefs and plans (as recorded in 'private'). The function $\mathcal{U}_{\text{why}_f}$ in (39) is an update rule for factive *Why*-questions: the interlocutor asks about a premise for an enthymeme justifying the *content* of 'l-m'. We use $p \therefore q$ to abbreviate the type of the enthymeme 'p hence q' and the notation $l = \langle x \mid . \rangle$ to say that x is the first element of the list l.

(39)
$$\mathcal{U}_{\text{why}_f} = \lambda\text{r}: \left[\text{shared}: \left[\text{l-m}: \begin{bmatrix}\text{e}: \text{Assert(SELF, OTHER)} \\ \text{ctnt}: T_c\end{bmatrix}\right]\right]. \left[\text{shared}: \begin{bmatrix}\text{qud} = \langle \lambda\text{p.(p} \therefore \text{r.shared.l-m.ctnt)} \mid . \rangle : \text{list}(\textit{Question}) \\ \text{l-m}: \begin{bmatrix}\text{e}: \text{Ask(OTHER,SELF)} \\ \text{ctnt}: \lambda\text{p.(p} \therefore \text{r.shared.l-m.ctnt)}\end{bmatrix}\end{bmatrix}\right]$$

Note that updating 'l-m' tacitly also updates 'moves'. Now, for meta-discursive *Why*-questions, the interlocutor inquires about the move *itself*. For the case of a question in the antecedent, this is the function $\mathcal{U}_{\text{why}_m}$ in (40).

(40)
$$\mathcal{U}_{\text{why}_m} = \lambda\text{r}: \left[\text{shared}: \left[\text{l-m}: \begin{bmatrix}\text{e}: \text{Ask(SELF,OTHER)} \\ \text{ctnt}: T_c\end{bmatrix}\right]\right]. \left[\text{shared}: \begin{bmatrix}\text{qud} = \langle \lambda\text{p.(p} \therefore \text{r.shared.l-m)} \mid . \rangle : \text{list}(\textit{Question}) \\ \text{l-m}: \begin{bmatrix}\text{e}: \text{Ask(OTHER,SELF)} \\ \text{ctnt}: \lambda\text{p.(p} \therefore \text{r.shared.l-m)}\end{bmatrix}\end{bmatrix}\right]$$

Now we can formalise (16), repeated here as (41).

(41) a. A: Do you love me ⟨unclear⟩?
b. B: Why?
c. A: ⟨unclear⟩ I love you so much.

The *Why*-question in (41b) aims at eliciting a reason for asking, not a motivation for the content being true. On a certain level of abstraction, this can be modelled in much the same way as a factive *Why?*. That is, we can represent the *fact* that one speaker has asked a question as a situation type. So, the 'eud' after (41c) can be put as (42).

(42)
$$\mathcal{E}_1 = \lambda\text{r}: \begin{bmatrix}\text{x} = \text{A}: \textit{Ind} \\ \text{y} = \text{B}: \textit{Ind} \\ \text{c}_{\textit{love}}: \text{love(x,y)}\end{bmatrix}. \left[\text{c}_{\textit{asked}}: \text{asked(r.x,?love(r.y, r.x))}\right]$$

Thus, after (41c), $\mathcal{E}_1$ is now under discussion. That is, B has to evaluate whether he can accommodate *A loving B* is a reason for asking (41a). We attributed the topos *'one wants to know if love is requited'* to this example in (17). This can be formalised as $\mathcal{T}_1$ in (43).

(43)
$$\mathcal{T}_1 = \lambda\text{r}: \begin{bmatrix}\text{x}: \textit{Ind} \\ \text{y}: \textit{Ind} \\ \text{c}_1: \text{love(x,y)}\end{bmatrix}. \left[\text{c}_{\textit{wtk}}: \text{want_to_know(r.x,?love(r.y,r.x))}\right]$$

Again we need to assume a tacit background topos. In this case, *'if someone desires to know something, this is a reason for asking for it'*.[16] This is the topos $\mathcal{T}_2$ in (44).

(44)
$$\mathcal{T}_2 = \lambda\text{r}: \begin{bmatrix}\text{x}: \textit{Ind} \\ \text{y}: \textit{Question} \\ \text{c}_{\textit{wtk}}: \text{want_to_know(x,y)}\end{bmatrix}. \left[\text{c}_{\textit{asked}}: \text{asked(r.x,r.y)}\right]$$

As before, computing $\mathcal{T}_2 \circ \mathcal{T}_1$ and restricting the domain to the proposition $love(y, x)$ for the individuals $x = A$ and $y = B$ yields $\mathcal{E}_1$.

As said, this is on a certain level of abstraction. The constraint $\text{c}_{\textit{ask}}$ differs from $\text{c}_{\textit{hospital}}$ in (36) in that the former specifies a *linguistic* situation. The DGB allows us to be more precise about what such linguistic situations are. We may represent 'asked(A,?love(B,A))' as the type in (45).

(45)
$$\left[\text{shared}: \left[\text{moves} = \left\langle . \,\middle|\, \begin{bmatrix}\text{e}: \text{Ask(A,B)} \\ \text{ctnt}: \text{?love(B,A)}\end{bmatrix} \,\middle|\, . \right\rangle : \text{list}(\textit{Illoc})\right]\right]$$

5 Conclusion

We have conducted an analysis of the functions that *Why*-questions can have in dialogue and explained them from the perspective of enthymemes and topoi. Our discussion covers the phenomenon broadly, but there remain open questions related to embedded *Why*-questions and elliptical *Why?*. The cornerstone of our analysis is a definition of what counts as a *reason*, *i.e.*, as an answer to a *Why*-question. We have formalised that notion in a TTR framework and formally described two examples for the major functions we have attributed to *Why*-questions in the informal analysis.

[16] Note that this is an example of a topos that appears generally reasonable, but fails to apply in many situations. *E.g.*, when asking would be embarrassing or socially dispreferred.

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