

The *doubt-whether* puzzle

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July 1, 2021*

Abstract

The English predicate *doubt* is known to exhibit a distinctive selectional restriction: it is compatible with declarative as well as *whether*-complements but is incompatible with constituent *wh*-complements. The interpretation of a *whether*-complement under *doubt* is also puzzling, as ‘*doubt whether p*’ is almost—but not completely—synonymous with ‘*doubt that p*’. I will argue that these behaviors of *doubt* can be given a semantic account, by making use of the mechanisms of HIGHLIGHTING and EXHAUSTIFICATION. *Doubt* expresses an existential doxastic attitude toward the negation of the highlighted content of the complement while having presuppositions that are sensitive to the ordinary content of the complement. Given that ‘*that p*’ and ‘*whether p*’ are equivalent in the highlighted content but non-equivalent in the ordinary content, the semantics explains fine-grained differences in interpretations between ‘*doubt whether p*’ and ‘*doubt that p*’. Furthermore, given the lack of a stronger scalemate, the interpretation of ‘*doubt that/whether p*’ undergoes strengthening due to exhaustification, akin to the behavior of ‘scaleless’ modals reported in the literature.

1 Introduction

The dubitative predicate *doubt* in English exhibits puzzling behaviors concerning its selectional restriction and its interpretation. As Karttunen (1977a,b) notes, *doubt* has a distinctive selectional restriction, where it is compatible with both declarative and polar-question (PolQ) complements,¹ but not with alternative-question (AltQ) complements and constituent-*wh* complements. As for the interpretation, Karttunen (1977b) suggests that the interpretation of a PolQ complement under *doubt* is equivalent to that of a corresponding *that* complement. However, close examination reveals that there are fine-grained dis-

* [acknowledgements to be added later]

¹In this paper, I will include *if* complements under the class of what I refer to as ‘PolQ complements’ and will collapse *whether* and *if* complements in my discussion. See, however, Iyeyri (2009) for differences in the historical development of *doubt-whether* and *doubt-if*.

tinctions between the interpretations of *doubt-that* and *doubt-whether*, which interact with negation in systematic ways, as we will see in detail shortly (Dixon, 2005). There are several formal semantic treatments of *doubt* in the literature, including Pruitt and Roelofsen (2011), Biezma and Rawlins (2012) and Anand and Hacquard (2013). However, to my knowledge, no existing treatment can successfully account for both the selectional restriction and the fine-grained semantic properties of *doubt*.

In this paper, I will argue that these puzzling behaviors of *doubt* can be accounted for by combining two independently motivated semantic mechanisms: HIGHLIGHTING (Pruitt and Roelofsen, 2011, Roelofsen and Farkas, 2015, Theiler, 2020) and EXHAUSTIFICATION (Fox, 2007, Bar-Lev and Fox, 2020, Jeretič, 2020, Mirrazi and Zeijlstra, 2021). The analysis will furthermore show that the selectional restriction of *doubt*, even though puzzling at first sight, can be given a semantic explanation, advancing the ongoing research programme that aims to give meaning-driven explanations of selectional restrictions for clause-embedding predicates (Uegaki 2015, Mayr 2018, Theiler et al. 2019, Uegaki and Sudo 2019; cf. also White and Rawlins 2016, 2020, White 2021 for different perspective).

The rest of the paper is structured as follows. In §2, I will introduce empirical properties of English *doubt* and posit three desiderata for a semantic analysis of the predicate. The desiderata consist of (i) the account of its selectional restriction; (ii) the account of its semantic properties; and (iii) the account of a link between the semantic properties and the selectional restrictions. Within the section, I will also discuss the behaviors of the counterparts of *doubt* based on a short survey of cross-linguistic data, which motivates a particular formulation of the third desideratum. §3 surveys two prominent analyses of *doubt*, i.e. Biezma and Rawlins (2012) and Pruitt and Roelofsen (2011), and shows that they do not provide a proper account of the semantic properties of *doubt* observed in §2. In §4, I will propose a concrete semantic analysis of *doubt*, making crucial use of the mechanisms of highlighting and exhaustification.

2 Desiderata for an analysis of *doubt*

In this section, I will discuss empirical properties of *doubt* following Karttunen (1977b), Dixon (2005) and Djärv (2019). I will furthermore present additional data from a number of non-English languages and explore to what extent the selectional restriction of *doubt* can be taken to be cross-linguistically stable. Based on these considerations, I will present a set of desiderata for a semantic analysis of English *doubt*.

2.1 The selectional restriction and interpretation

Karttunen (1977a,b) and Huddleston and Pullum (2002: 983) observe that the English predicate *doubt* exhibits a peculiar selectional restriction, exemplified in (1) below:

- (1) a. Ann **doubts** that they serve breakfast. (DECLARATIVE)
 b. Ann **doubts** whether they serve breakfast. (POLQ)
 c. *Ann **doubts** whether they serve breakfast or not. (POLQvN)
 d. Ann **doubts** whether they serve coffee or tea. (ALTQ)
 e. *Ann **doubts** who has passed the test. (CONSTITUENT *WH*)

I refer to the types of complements exemplified in (1) using the labels in parentheses to the right: DECLARATIVE, POLQ, POLQvN, ALTQ and CONSTITUENT *WH*, partially following Biezma and Rawlins (2012). As exemplified in (1), *doubt* is compatible with both a declarative complement and a PolQ complement. On the other hand, it is not compatible with either a PolQvN or a constituent-*wh* complement (Huddleston and Pullum 2002: 983; see also Huddleston 1994). Even though a disjunctive complement as in (1d) is by itself acceptable under *doubt*, its interpretation suggests that the complement is acceptable only if it is interpreted as a PolQ complement on a par with (1b), rather than as an AltQ complement (Karttunen, 1977b).²

The particular selectional pattern in (1) is not observed with other classes of clause-embedding predicates in English. As is well-known, the selectional restrictions of many English clause-embedding predicates can be stated in terms of declarative and interrogative complements, where the latter includes PolQ, PolQvN, AltQ, and constituent-*wh* complements in my terminology. Specifically, ANTI-ROGATIVE PREDICATES, such as *believe* and *hope*, only embed declarative complements; RESPONSIVE PREDICATES, such as *know* and *tell*, embed either declarative or interrogative complements; ROGATIVE PREDICATES, such as *wonder*, only embed interrogative predicates (Grimshaw, 1979, Ginzburg, 1995, Lahiri, 2002, Theiler et al., 2019). These patterns are exemplified below:

- (2) a. Ann **believes** that they serve breakfast. (declarative)
 b. *Ann **believes** whether they serve breakfast. (PolQ)
 c. *Ann **believes** whether they serve breakfast or not. (PolQvN)
 d. *Ann **believes** whether they serve coffee or tea. (AltQ)

²Interestingly, the rating results for *doubt* in the MegaAttitudes database (White and Rawlins, 2016, 2020) do not show significant difference between the acceptability of declarative and PolQ complement on the one hand (declarative: 7-point likert scale response averaged 6.67 ± 0.80 , $n = 30$; PolQ: response averaged 6.37 ± 1.16 , $n = 30$) and the constituent-*wh* complement on the other (6.13 ± 1.40 , $n = 15$). I used Ver. 2 of the MegaAcceptability database (<http://megaattitude.io/projects/mega-acceptability/>). The ratings for the declarative complement are for the frames ‘NP V that S’ and ‘NP V that S[+future]’ (15 observations each), those for the PolQ complement are for the frames ‘NP V whether S’ and ‘NP V whether S[+future]’ (15 observations each), and those for the *wh* complement are for the frame ‘NP V whichNP S’ (15 observations). Any of the pairwise comparison of responses across the complement types did not reach statistical significance, according to likelihood ratio tests of linear mixed-effects models fitted to the data. The database does not contain syntactic frames corresponding to PolQvN and AltQ complements. See White and Rawlins (2016) and White and Rawlins (2020) for methodologies of their data collection. In this paper, I will assume the judgements in (1) reported in the literature, and leave open the question of why the relevant contrasts were not observed in White and Rawlins’s (2016, 2020) experiments.

- e. *Ann **believes** who has passed the test. (constituent *wh*)
- (3) a. Ann **knows** that they serve breakfast. (declarative)
- b. Ann **knows** whether they serve breakfast. (PolQ)
- c. Ann **knows** whether they serve breakfast or not. (PolQvN)
- d. Ann **knows** whether they serve coffee or tea. (AltQ)
- e. Ann **knows** who has passed the test. (constituent *wh*)
- (4) a. *Ann **wonders** that they serve breakfast. (declarative)
- b. Ann **wonders** whether they serve breakfast. (PolQ)
- c. Ann **wonders** whether they serve breakfast or not. (PolQvN)
- d. Ann **wonders** whether they serve coffee or tea. (AltQ)
- e. Ann **wonders** who has passed the test. (constituent *wh*)

Among responsive predicates, the restricted class of EMOTIVE FACTIVES, such as *surprise*, *annoy* and *bother*, are special in that they are incompatible with PolQ, PolQvN and AltQ complements (Karttunen, 1977a):

- (5) a. Ann **is surprised** that they serve breakfast. (declarative)
- b.??Ann **is surprised** (at/by) whether they serve breakfast. (PolQ)
- c.??Ann **is surprised** (at/by) whether they serve breakfast or not. (PolQvN)
- d.??Ann **is surprised** (at/by) whether they serve coffee or tea. (AltQ)
- e. Ann **is surprised** by who has passed the test. (constituent *wh*)

The selectional patterns of these classes of predicates are clearly distinct from that of *doubt*, which are compatible only with declarative and PolQ complements, as shown in (1).³

³Recently, White (2021) has pointed out that there are examples involving PolQ complements embedded by *believe*, *think*, *hope* and *fear*, which have traditionally been assumed to be interrogative predicates. Some of his data, taken from attested examples in corpora, are shown below:

- (i) (White, 2021: 13, (19))
 - a. [...] I didn't believe the Bible growing up, I wasn't a Christian growing up, I struggled to **believe whether** I could trust the Scriptures [...]
 - b. We can choose to **believe whether** the word of God is true [...] or not.
- (ii) (White, 2021: 11, (13-15))
 - a. When Jan Brown completed her safety briefing for the passengers, she tried to **think whether** she had covered everything.
 - b. I'm trying to **think whether** I'd have been a star today or not.
- (iii) (White, 2021: 14, (23))
 - a. I was **hoping whether** you are able to guide me.
 - b. I was **hoping whether** someone with more experience could confirm my understanding of a few points.
- (iv) (White, 2021: 14-15, (25))
 - a. Interstellar space is so vast that there is no need to **fear whether** stars in the Andromeda galaxy will accidentally slam into the Sun.

In addition to the peculiar selectional restriction, the interpretation of *doubt* is also intriguing. Karttunen (1977b) suggests that the two complement types *doubt* allows give rise to equivalent interpretations. That is, according to Karttunen, the following two examples, repeated from above, are equivalent:

- (1) a. Ann **doubts** that they serve breakfast. (declarative)
 b. Ann **doubts** whether they serve breakfast. (PolQ)

Specifically, Karttunen points out that both of these examples can be paraphrased as ‘Ann doesn’t believe the proposition that they serve breakfast.’ Based on this observation, he argues that the semantic value of a *whether*-clause under *doubt* shouldn’t be treated as an embedded polar question, and that it should be treated as a proposition on a par with a corresponding *that*-clause. This proposal is the basis of two prominent semantic analyses of *doubt*, to be discussed in the next section: Biezma and Rawlins (2012) and Pruitt and Roelofsen (2011).

However, there is evidence suggesting that *doubt-that* and *doubt-whether* are not equivalent. This is discussed by Dixon (2005: 239), who makes the following observations about the contrast in meaning between *doubt-that* and *doubt-whether*. First, in positive environments, ‘*I doubt that* φ ’ is most likely to imply disagreement with an assertion which has been made’ that φ . On the other hand, ‘*I doubt whether* φ ’ ‘could be used when no one has seriously suggested that φ , but the idea has just been floated’. Secondly, the two constructions exhibit starkly different behaviors in negative environments. *Doubt-that* is acceptable under negation, and licenses the inference that the attitude holder believes the complement.⁴ This is exemplified in the following:⁵

- (6) a. I don’t doubt that he is sick.
 ~→ ‘I believe that he is sick.’ (Dixon, 2005: 239)
 b. She doesn’t doubt that they serve breakfast.
 ~→ ‘She believes that they serve breakfast.’

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- b. I **fear whether** this test would run safely on the oxygen sensor as it has a lot of drawback when compared with the others.

Based on these data and an additional assumption that these predicates disallow other types of interrogative complements, one might think that these predicates share their selectional restrictions with *doubt*. However, corpus data suggest that *believe/hope/fear-whether* cases are significantly less frequent than *doubt-whether*. The transitional probabilities of *believe-whether*, *hope-whether* and *fear-whether* (the frequencies of the sequences given various inflectional realizations of the verb *believe/hope/fear*) in the iWeb corpus (<https://www.english-corpora.org/iweb/>) are 87/4197731, 16/2784840, and 34/403764, respectively. On the other hand, the transitional probability of *doubt-whether* is 4426/290569. Although frequency per se does not inform us about the qualitative nature of these constructions, I take this to be a viable reason to treat *doubt* separately from *believe*, *hope* and *fear* for the purpose of this paper. As for *think-whether*, Özyıldız (2021) shows that *think* is in fact responsive under its eventive interpretation, as in *Alice is thinking who she should invite for dinner*, and that the examples in (ii) involve this eventive *think*.

⁴Dixon doesn’t describe the phenomenon in terms of inference. He writes: ‘*I don’t doubt that he is sick*, and is very close in meaning to the positive assertion *I believe that he is sick*’ (Dixon, 2005: 239).

⁵Roelofsen (2019, fn. 12) quotes similar observations about *doubt* under negation in *The American Heritage dictionary* (<https://www.ahdictionary.com/>).

The existence of this inference is experimentally confirmed by rating studies reported in Djärv (2019: 147-157). Specifically, Djärv has investigated levels of the attitude holder’s commitment to the declarative complement in positive and negated sentences with a range of attitude verbs including *believe* and *doubt*, and observed that the scores for the commitment to *p* are as high with ‘*not doubt that p*’ as with ‘*believe that p*’. Similar observations are also reported in Kane et al. (2021).

On the other hand, when we turn to *doubt-whether*, the general observation is that it is unacceptable under negation:

- (7) a.??I don’t doubt whether he is sick. (Dixon, 2005: 239)
b.??She doesn’t doubt whether they serve breakfast.

These observations suggest that *doubt-that* and *doubt-whether* are in fact distinct in their interpretations, contra Karttunen’s (1977b) claims.

All in all, there are two empirical properties of *doubt* that have to be accounted for. One is its selectional restriction—its compatibility with both declarative and PolQ complements and incompatibility with other types of interrogative complements—and the other is the fine-grained differences in interpretations between *doubt-that* and *doubt-whether*. In principle, there are two approaches we can take to analyse these properties of *doubt*. One is to pursue a semantic analysis of *doubt* which *uniformly* explains both its selectional restriction and its interpretation. The other is to provide an analysis in which the selectional restriction and the interpretation are accounted for independently from each other. One concrete analytical possibility within the latter approach is to account for the selectional restriction in terms of syntactic features while positing an independent lexical entry that accounts for the semantic properties. In this paper, I will not be able to offer a definitive argument in favor of one approach over the other. However, I will explore possible links between the selectional restriction and the interpretation of dubitative predicates based on a small-scale survey of cross-linguistic data and pursue a unified semantic analysis of *doubt* which is compatible with the relevant cross-linguistic observations, to which I now turn.

2.2 Cross-linguistic picture

Karttunen (1977b) ends his squib by mentioning that the Finnish counterpart of *doubt*, i.e., *epäillä*, behaves in a way similar to that of English *doubt*. Biezma and Rawlins (2012: fn.33) also suggest that the selectional restrictions of dubitative predicates (i.e., *doubt* and its counterparts) are cross-linguistically stable. If this speculation is correct, it would motivate an approach that links the selectional restriction of *doubt* with its lexical semantics (following the approach advocated by Pesetsky 1991 and proposed more recently for clause-embedding predicates by Theiler et al. 2019 and Mayr 2019 a.o.), as opposed to an approach that treats the selectional restriction independently from lexical semantics. To evaluate this speculation, this section offers a short survey of the

selectional properties of dubitative predicates in 13 languages (Swedish, Czech, Russian, Estonian, French, Italian, Spanish, Portuguese, Romanian, Sardinian, Mandarin, Japanese and Turkish). As my data are quite limited and heavily overrepresented by European languages, the goal of this section is not to make concrete claims about cross-linguistic universals or sources of variation. Rather, my goal here is to explore to what extent cross-linguistic data from the (limited) language sample motivate a semantic analysis of the selectional restriction of *doubt* and its cross-linguistic counterparts. If the selectional restriction of dubitative predicates is stable across languages, it will provide an argument for positing a link between the dubitative lexical semantics and selectional restrictions (though such a pattern will by no means *necessitate* this approach). To preview, the cross-linguistic picture suggests that clausal complements of dubitative predicates across languages are limited to declarative complements as well as interrogative complements in which a specific answer is *mentioned*, although there are language-specific restrictions as to what types of such interrogative complements are allowed. For example, English *doubt* is normally incompatible with PolQvN complements while many Romance languages normally disallow PolQ complements under the dubitative predicate. These findings motivate a semantic analysis of *doubt* and its counterparts which (a) predicts that the predicate only allows declarative and answer-mentioning interrogative complements by virtue of its lexical semantics; and (b) is compatible further language-specific restriction on complementation.

2.2.1 Cross-linguistic similarities

In many languages in the sample, dubitative predicates are compatible with both declarative and PolQ complements, while they are incompatible with constituent-*wh* complements. This is shown in the following examples from Swedish, Czech, Russian, Estonian, Mandarin, Japanese and Turkish.

(8) Swedish⁶

- a. Lisa **tvivlar** på [att hon kan komma på festen].
Lisa doubts on that she can come to party.DEF
'Lisa doubts that she can come to the party.'
- b. Lisa **tvivlar** på [om hon kan komma på festen].
Lisa doubts on whether she can come to party.DEF
'Lisa doubts whether she can come to the party.'
- c.??Lisa **tvivlar** på [vad hon ska göra].
Lisa doubts on what she will do

(9) Czech⁷

⁶Examples and judgments due to Kajsa Djärv (p.c.).

⁷Examples a and b from The Czech National Corpus (korpus.cz) and example c and its judgment due to Radek Šimfk (p.c.).

- a. ... A **pochybuj**, [že se k tomu ještě někdy
and doubt.IPFV.1SG that REFL to that.DEM still some.time
odhodlám].
take.courage.PFV.1SG
'And I doubt that I will take courage some time to do it.'
- b. ... já jsem chvílemi **pochybovala**, [jestli
I AUX.1SG now.and.then doubt.IPFV.PST.SG.F whether
dokážu být matkou].
manage.PFV.1SG be.INF mother
'... now and then I doubted whether I'll manage to be a mother.'
- c. ***Pochybuj** [kdy bude pršet].
doubt.1SG when will.3SG rain.INF

(10) **Russian**⁸

- a. ja **somneva-ju-s'** [čto svin'ji ume-jut leta-t'].
I doubt-PRS.1SG-REFL COMP pigs can-PRS.3PL fly-INF
'I doubt that pigs can fly.'
- b. ?ja **somneva-ju-s'** [ume-jut=li svin'ji leta-t'].
I doubt-PRS.1SG-REFL can-PRS.3PL=Q pigs fly-INF
'I doubt whether pigs can fly.'
- c. *ja **somnevajus'** [kto prišel na večerinku]
I doubt.PRS.1SG who arrive.PST.M on party.ACC

(11) **Estonian**⁹

- a. **Kahtlen**, [et kass kargas]
doubt.1SG that cat jumped
'I doubt that a cat jumped.'
- b. **Kahtlen**, [kas kass kargas]
doubt.1SG whether cat jumped
'I doubt whether a cat jumped.'

(12) **Mandarin Chinese**¹⁰

- a. wo **huaiyi** [mingtian hui qing].
I doubt sunny FUT tomorrow
'I doubt it will sunny tomorrow.' (Huang, 2020: 6)
- b. xiaohuang **huaiyi** [xiaotang shi-bushi xihuan xiaoqiang].
Huang doubt Tang be-NEG.be like Qiang
'Huang doubts whether Tang likes Qiang' (Huang, 2020: 6)

⁸Examples and judgments due to David Erschler (p.c.).

⁹Examples and judgments due to Martin Aher (p.c.).

¹⁰Examples (12b) and (12c) involve the so-called A-not-A question in the complement. Following Hagstrom (2006) and Huang (2020), I assume that Mandarin A-not-A questions semantically correspond to English PolQs. See Sect. 4.3 for more discussion on the treatment of A-not-A questions. Also, in (12d), the *wh*-item *shei* allows a reading as a *wh*-indefinite but not as a question word.

- c. renmen shenzhi kaishi **huaiyi** [aoyunhui neng-fou anshi
 people even start doubt Olympics can-NEG on.time
 zhaokai].
 happen
 ‘People even began to doubt if the Olympics can happen on time.’
 (Yuan, 2014: 4)
- d. wo **huaiyi** [shei hui chuxian zai zheli].
 I doubt who will appear at here
 *‘I doubt who will appear here’
 ‘I suspect that somebody will appear here’

(13) **Japanese**¹¹

- a. Hana-wa [chikyuu-ga marui koto]-o **utagatteiru**.
 Hana-TOP earth-NOM round fact -ACC doubt.ASP.
 ‘Hana doubts that the earth is round.’
- b. Hana-wa [chikyuu-ga marui-ka] **utagatteiru**.
 Hana-TOP earth-NOM round-COMP_{int} doubt.ASP.
 ‘Hana doubts whether the earth is round’
- c. *Hana-wa [dare-ga kita-ka] **utagatteiru**.
 Hana-TOP who-NOM came-COMP_{int} doubt.ASP

(14) **Turkish**¹²

- a. Opal [Ayşe-nin o-nu sev-diğ-in-den]
 Opal Ayşe-GEN 3S-ACC like-NMZ-3S.POSS-ABL
şüphe-li.
 doubt-SUF.COP.3s
 ‘Opal doubts that Ayşe likes her.’
- b. Opal [Ayşe-nin o-nu sev-ip sev-me-diğ-in-den]
 Opal Ayşe-GEN 3S-ACC like-CONJ like-NEG-NMZ-3S.POSS-ABL
şüphe-li.
 doubt-SUF.COP.3S
 ‘Opal doubts whether Ayşe likes her.’

2.2.2 Points of variation

Interestingly, the counterparts of *doubt* in many Romance languages (with a possible exception of Spanish) do not readily allow a PolQ complement. This is pointed out by Fagard et al. (2016), who mention the following examples:

(15) Fagard et al. (2016: 28, (66))¹³

- a. *je **doute** s’il est arrivé (French)

¹¹The author’s own judgment. The verb *utagau* ‘doubt’ selects a factive complementizer *koto* in Japanese (Kuno, 1973, Nakau, 1973).

¹²Examples and judgments due to Deniz Özyıldız (p.c.).

¹³Fagard et al. (2016) do not provide glosses for these examples.

- b. ***dubito** se è arrivato (Italian)
 - c. **dudo** si llegó (Spanish)
 - d. ***dúvido** se chegou / chegasse (Portuguese)
 - e. ***mă îndoiesc** dacă a sosit (Romanian)
 - f. ***dubbido** si est arribau (Sardinian)
- ‘I doubt if he has arrived’

This said, further examination suggests that PolQ complements under the counterparts of *doubt* are not entirely impossible at least in French and Italian. This is exemplified by the following attested examples:

(16) **French:** *douter* + PolQ complement¹⁴

- a. Je **doute** s’il arrivera un jour à ses fins
I doubt.1SG if=he arrive.3SG.FUT one day to his goals
‘I doubt if he will ever achieve his goals.’
- b. Il se mit à **douter** si elle était venue
he himself put to doubt if she be.3SG.IMPERF come
‘He started to doubt if she would come.’

(17) **Italian:** *dubitare* + PolQ complement¹⁵

- a. **Dubito** se potevamo accendere un fiammifero in che
doubt.1SG if can.IMP.1PL light a match in the
atmosphere.
atmosphere
‘I doubt if we can light a match in the atmosphere.’
- b. **Dubito** se apprezzerete nel loro giusto valore le
doubt.1SG if appreciate.FUT.2PL in their proper value the
cause delle mie sofferenze.
cause of=the my sufferings
‘I doubt if you will appreciate the causes of my sufferings in their proper value.’

Thus, although it may generally be the case that the Romance languages listed in (15) except for Spanish disallow PolQ complements under the counterpart of *doubt*, this restriction is not categorical.

Another possible point of variation concerns PolQvN complements. In many of the languages sampled, PolQvN complements are at least marginally acceptable under the dubitative predicate, in contrast to the judgment for English due

¹⁴Examples from Sketch Engine (www.sketchengine.eu), due to Fabienne Martin (p.c.). The dictionary *Trésor de la langue française* also mentions the following example:

- (i) Je **doute** si je partirai demain
I doubt.1SG if I leave.1SG.FUT tomorrow
‘I doubt if I leave tomorrow.’

However, this particular example is quite marked according to native speakers.

¹⁵Examples from Sketch Engine.

to I discussed in the previous section. This is exemplified below for Swedish, Czech, and Japanese:

(18) **Swedish**

?Lisa **tvivlar på om** hon kan komma på festen **eller inte**.
 Lisa doubts on whether she can come to party.DEF or not
 ‘Lisa doubts whether she can come to the party or not.’

(19) **Czech**

Začal **pochybovat, jestli** jeho přítelkyně přijde **nebo**
 started.SG.M doubt.INF whether his girlfriend come.PFV or
ne.
 not
 ‘He started doubting whether his girlfriend will come at all.’

(20) **Japanese**

Hana-wa [chikyuu-ga marui-**ka-dooka**] **utagatteiru**.
 Hana-TOP earth-NOM round-COMP_{int}-or.not doubt.ASP.
 ‘Hana doubts whether the earth is round’

It is also worth noting that the syntactic forms of the PolQ complements in Mandarin and Turkish—exemplified in (12b-c) and (14b) respectively—involve a negative affix attaching to a (reduplicated) predicative head, superficially resembling PolQvN clauses. However, it is unclear if the semantics of these clauses completely align with that of English PolQvN (see Huang 1991, McCawley 1994, Hagstrom 2006 for relevant discussion on the so-called Mandarin A-not-A questions and similar constructions, exemplified in (12b-c)). I will come back to this point later in §4.

Furthermore, at least in some Romance languages, speakers report that the dubitative predicate sound acceptable with PolQvN or AltQ complements:

(21) **French**¹⁶

- a. On **doute** si l’acte auquel on pense est moral ou non.
 we doubt if the=act which we think be moral or not
 ‘We doubt if the act we are thinking about is moral or not.’
- b. Enfin il est normal de **douter** si notre écrit est correct ou non.
 Finally it is normal to doubt if our writing is correct or not.
 ‘Finally, it is normal to doubt if our writing is correct or not’

(22) **Italian**¹⁷

- a. **Dubito** se accettare o no.
 doubt.1SG if accept or not
 ‘I doubt whether to accept or not.’

¹⁶Examples from Sketch Engine (sketchengine.eu)

¹⁷Examples from <https://dizionari.repubblica.it/Italiano/D/dubitare.html> and <https://dizionario.internazionale.it/parola/dubitare> identified by Giosuè Baggio (p.c.).

- b. **Dubito** se intervenire o stare zitto.
 doubt.1SG if intervene or stay silent
 ‘I doubt whether to intervene or shut up.’

2.2.3 A tentative generalization

All in all, the data suggest that dubitative predicates in the languages sampled are compatible with declarative complements as well as PolQ, PolQvN, and/or AltQ complements, although there are language-specific restrictions as to what types of interrogative complements are permitted. For example, many Romance languages disallow PolQ complements while English disallows PolQvN and AltQ complements (at least according to the traditional judgments; Karttunen 1977b, Huddleston and Pullum 2002). One way to generalize the cross-linguistic picture is to group together PolQ, PolQvN, and AltQ as those interrogative complements that *mention a specific answer* (ANSWER-MENTIONING INTERROGATIVE COMPLEMENTS for short). The emerging generalization is the following:

(23) **Hypothesized cross-linguistic generalization**

Cross-linguistically, dubitative predicates are in principle compatible with answer-mentioning interrogative complements (modulo further language-specific restrictions on permissible types of such complements) in addition to declarative complements. In contrast, they are incompatible with constituent *wh* complements.

To make any conclusion about possible links between the lexical semantics and the selectional restrictions based on a generalization like (23), we also have to identify any cross-linguistic variation in the *lexical semantics* of dubitative predicates. My preliminary investigation suggests that the relevant examples from the languages considered above can be translated to English using the predicate *doubt*. Furthermore, Dixon’s (2005) observations regarding the interaction between the predicate and the negation hold at least for Swedish, Czech, Russian, Estonian, Japanese, Turkish, and French. That is, in these languages, dubitative + declarative under negation gives rise to the inference that the attitude holder believes the complement¹⁸ while dubitative + PolQ under negation is low in acceptability. This suggests that the lexical semantics of the relevant predicates is fairly stable across languages.¹⁹

This in turn means that the data are compatible with an analysis where the generalization in (23) is analyzed in terms of a mechanism rooted in the semantics of dubitative predicates, which is taken to be cross-linguistically general. If such a meaning-driven account of the coarse-grained selectional restriction of dubitative predicates (i.e. compatibility with answer-mentioning complements and incompatibility with constituent *wh* complements) is possible at all,

¹⁸Djäv (2019) replicates the aforementioned rating-study results for German and Swedish.

¹⁹The Mandarin predicate *huaiyi*, however, seems to be ambiguous between ‘doubt’ and ‘suspect’ (Yuan, 2014, Huang, 2020). The selectional pattern exemplified in (12) holds under the ‘doubt’ interpretation, according to native speaker judgments (Yunchong Huang, Ciyang Qing, p.c.).

it should be preferred over an alternative account where the restriction is accounted for independently of the dubitative lexical semantics. For, such an alternative would not be able to capture the cross-linguistic generalization in (23). In the rest of the paper, I will explore such a semantic account of the selectional restriction of *doubt*.

As I suggested above, my goal in this paper is not to make claims about the possible sources of variation among languages. In particular, my analysis will leave open what determines the language-specific restrictions on the types of answer-mentioning complements a dubitative predicate is compatible with. My analysis of English *doubt* to be presented in §4 will account for the cross-linguistically general selectional restriction of dubitative predicates, i.e., its compatibility with answer-mentioning complements and incompatibility with constituent *wh* complements, as well as the English-specific facts, i.e., its incompatibility with PolQvN and AltQ complements. The analysis of the English-specific facts, however, will be dependent on extra assumptions about the semantics of the English PolQvN and AltQ constructions. In §4, I will speculate on the possibility that these extra assumptions are language-dependent and thus provide a source of variation which we observed in this section. Nevertheless, it will be beyond the scope of the present paper to evaluate this speculation about sources of cross-linguistic variation.

2.3 Interim summary

In this section, I have surveyed the core empirical properties of *doubt* in English (§2.1) as well as those of its counterparts in several non-English languages (§2.2). Specifically, these properties are the predicates' selectional restrictions and their interpretations relative to particular complement types. In English, it is observed that *doubt* is compatible with declarative and PolQ complements but is incompatible with PolQvN, AltQ and constituent *wh* complements. As for the interpretation, *doubt* exhibits slightly different interpretations depending on whether it takes a declarative or a PolQ complement: (a) $\lceil \textit{doubt that } p \rceil$ suggests that *p* has been asserted in the context while $\lceil \textit{doubt whether } p \rceil$ doesn't give rise to the same inference and only suggests that the idea of *p* 'has been floated' (Dixon, 2005: 239). Furthermore, $\lceil \textit{not doubt that } p \rceil$ leads to the inference that the attitude holder believes *p* while $\lceil \textit{not doubt whether } p \rceil$ is degraded at best. Dubitative predicates in the non-English languages surveyed show similar selectional and semantic properties at an abstract level. That is, they only select for answer-mentioning complements and their interpretation is comparable to English *doubt* although there are several fine-grained variations.

Given these observations, I posit the following three desiderata for a proper analysis of the English *doubt*:

1. An account of its selectional restriction;
2. An account of its variable interpretation relative to the type of the complement; and

3. An account of the link between its interpretation and its selection of declarative and answer-mentioning interrogative complements.

The first two desiderata are straightforward. The third desideratum is motivated by the cross-linguistic generalization hypothesized based on the observations in §2.2. To rephrase it, we would like our account of the selectional restriction of *doubt* to be partially meaning-driven, so that its compatibility with answer-mentioning complements and incompatibility with constituent *wh* complements is derived from its semantic properties. An analysis that satisfies the above three desiderata would not only capture the properties of *doubt*, but also provide an account of the cross-linguistic generalization about the correlation between dubitative semantics and selectional restrictions. Here, it is important that the third desideratum only concerns the selectional restriction at the coarse-grained level (i.e. compatibility with answer-mentioning complements and incompatibility with constituent *wh* complements) and not the fine-grained level (i.e. compatibility with declarative and PolQ complements and incompatibility with PolQvN, AltQ and constituent *wh* complements). As the selectional restriction of dubitative predicates varies at the fine-grained level as we have seen in §2.2, it is not necessary and presumably not desirable if the fine-grained semantics of the English *doubt* is inherently rooted in lexical semantics. Our meaning-driven account of the selectional restriction has to be compatible with further restrictions due to language-specific factors.

3 Existing accounts

There are two prominent compositional semantic treatments of the selectional pattern of dubitative predicates: Pruitt and Roelofsen (2011) and Biezma and Rawlins (2012).²⁰ The overarching goals of both articles concern the semantics and pragmatics of polar and alternative questions in general, and the analysis of *doubt* is not their main focus, but rather a piece of supporting evidence for their main proposals. This said, it is worth discussing their treatments of dubitative predicates in detail, as doing so will help us highlight the nature of the issue. In both cases, the authors follow in the footsteps of Karttunen's (1977b) analytical insight in identifying the interpretation of a declarative complement and a corresponding PolQ complement at some level of semantic representation. This theoretical assumption provides a crucial ingredient as they account for the selectional restriction of *doubt* in terms of its semantics. However, as we will see, both analyses fall short of providing a precise account of the interpretation of *doubt* conditioned by the complement types, thus failing to meet our second desideratum. Furthermore, precisely because their analyses of the interpretation of *doubt* is incomplete, it is difficult to evaluate to what extent they meet our third desideratum, that is, if they can offer an explanation of the link

²⁰Another prominent formal analysis of *doubt* is in Anand and Hacquard (2013), but the analysis does not consider PolQ complements.

between the semantics of dubitative predicates and their cross-linguistically general selectional restrictions.

3.1 Biezma and Rawlins (2012)

Biezma and Rawlins’s (2012) account is based on the proposal that polar interrogative complements have a singleton proposition-set denotation, as exemplified in the following:

$$(24) \llbracket \text{whether it is raining} \rrbracket = \{ \text{it is raining} \}$$

According to Biezma and Rawlins, the representation of bipolar alternative propositions, e.g. $\{ \text{it is raining}, \neg \text{it is raining} \}$ —commonly associated with the semantics of polar questions after Hamblin (1973)—is attributed to pragmatics, building on earlier proposals along the same lines by Roberts (1996) and Gunlogson (2001) among others. Specifically, in the case of matrix polar questions, the Q-operator that heads the clause is assumed to carry the presupposition that the Question-under-Discussion (QUD) is a non-singleton and includes the semantic content of its prejacent (e.g. (24)) as its subset. If the polar question is embedded, a coercion mechanism can kick in, which turns a singleton set into the corresponding bipolar set. The coercion operation is driven by the following two statements:

$$(25) \text{ Anti-singleton constraint schema (Biezma and Rawlins, 2012: 393, (54))}$$

For any Q-embedding verb V:
 $\llbracket V [Q \alpha] \rrbracket$ is defined only if $\llbracket [Q \alpha] \rrbracket > 1$

$$(26) \text{ Anti-singleton coercion (Biezma and Rawlins, 2012: 393, (55))}$$

If $\llbracket [\alpha] \rrbracket = 1$, where α is of type $\langle s, t \rangle$ and denotes $\{ A \}$, then α can be coerced (as a last resort) into the denotation $\{ \lambda w. A(w), \lambda w. \neg A(w) \}$

In contrast to PolQ complements, PolQvN complements and AltQs are analyzed as having two-membered denotations, as follows:

$$(27) \text{ a. } \llbracket \text{whether or not it is raining} \rrbracket = \{ \text{it is raining}, \neg \text{it is raining} \}$$

$$\text{ b. } \llbracket \text{whether Jo likes coffees} \uparrow \text{ or tea} \downarrow \rrbracket$$

$$= \{ \text{Jo likes coffee}, \text{Jo likes tea} \}$$

This means that the anti-singleton coercion does not occur in these types of complements.

The behavior of dubitative predicates is presented by Biezma and Rawlins (2012) as a piece of evidence for the singleton treatment of polar questions,²¹ along with other phenomena, such as the behavior of rising declaratives, disjoined polar questions, and answer particles. The argument based on dubitative predicates goes as follows, *assuming* Karttunen’s claim that $\lceil \text{doubt that } p \rceil$ and $\lceil \text{doubt whether } p \rceil$ are equivalent. The supposed equivalence can be naturally

²¹Related claims are made in Rawlins (2008) as well.

accounted for under the proposed analysis. This is so because, according to their compositional semantics based on Alternative Semantics (Hamblin, 1973, Rooth, 1985, 1992, Kratzer and Shimoyama, 2002, Shimoyama, 2006), the denotation in (24) is equivalent to the denotation of a declarative complement clause, as follows:

$$(28) \llbracket \text{that it is raining} \rrbracket = \{ \text{it is raining} \}$$

A similar analysis is not straightforward if a polar question semantically denotes a two-membered bipolar set.

Their analysis furthermore accounts for the selectional restriction of *doubt*. They argue that dubitative predicates like *doubt* “does not differentiate among types of (finite) CPs, but S-selects for singleton alternative sets” (Biezma and Rawlins, 2012: 395). This explains the fact that dubitative verbs are compatible with both declarative complements like (24) and polar question complements like (28). Furthermore, the proposal accounts for the incompatibility of *doubt* with PolQvN and AltQ complements, whose denotations are two-membered.²²

At this point, it is easy to see that Biezma and Rawlins (2012) fail to capture Dixon’s (2005) observation about the difference in interpretation between *doubt-that* and *doubt-whether*. In fact, it is impossible for their analysis to capture any difference between the two, as *doubt* combines with the same semantic content in the two cases, i.e., $\llbracket \text{that } p \rrbracket = \llbracket \text{whether } p \rrbracket$. This makes any attempt to explain selectional restriction based on their semantic analysis of *doubt* rather pointless. If the underlying semantic analysis is inaccurate, it is not straightforward to evaluate to what extent the analysis is successful in achieving a meaning-driven analysis of the selectional pattern.

3.2 Pruitt and Roelofsen (2011)

Pruitt and Roelofsen (2011) have proposed another analysis of the selectional restriction of *doubt*, by combining alternative semantics with the notion of HIGHLIGHTING (Roelofsen and van Gool, 2010, Roelofsen and Farkas, 2015, Theiler, 2020). Just like Biezma and Rawlins (2012), their analysis is set in alternative semantics where a clausal complement denotes a set of propositions as its semantic value, regardless of whether it is declarative or interrogative. Yet, unlike Biezma and Rawlins (2012), Pruitt and Roelofsen treat PolQ

²²Although it is not made explicit, Biezma and Rawlins (2012) presumably assume that dubitative predicates do not trigger the anti-singleton coercion in (27). If the coercion were to apply to a PolQ complement embedded by *doubt*, it would denote a bipolar set, resulting in a situation where it has a semantic value that is equivalent to the corresponding PolQvN complement, contrary to what is intended. Biezma and Rawlins are not explicit about what lexical property of dubitative predicates is responsible for the lack of the coercion operation, but one plausible interpretation of their proposal is that the coercion is triggered if and only if a non-singleton proposition-set is s-selected by the embedding predicate. In other words, a predicate is ‘Q-embedding’ for the purpose of the schema in (25) iff it s-selects for a non-singleton set. According to this view, since dubitative predicates s-select for a singleton set, they do not trigger the anti-singleton coercion.

complements as having a bipolar, two-membered, denotation while declarative *that* complements as having a singleton denotation. At this level, PolQ complements are treated on a par with PolQvN and AltQ complements. This is exemplified in the following:

- (29) a. $\llbracket \text{whether it is raining} \rrbracket^o = \{\text{it is raining}, \neg \text{it is raining}\}$
 b. $\llbracket \text{whether it is raining or not} \rrbracket^o = \{\text{it is raining}, \neg \text{it is raining}\}$
 c. $\llbracket \text{whether Jo likes coffee}\uparrow \text{ or tea}\downarrow \rrbracket^o = \{\text{Jo likes coffee}, \neg \text{Jo likes tea}\}$
 d. $\llbracket \text{that it is raining} \rrbracket^o = \{\text{it is raining}\}$

This said, what we have in (29) is not the only semantic representation of complements for Pruitt and Roelofsen (2011). In order to analyze the behavior of answer particles *yes/no* to polar questions and to AltQs, Pruitt and Roelofsen crucially assume a separate level of semantic representation from the ORDINARY SEMANTIC VALUES in (29), which they call HIGHLIGHTED SEMANTIC VALUES, written with $\llbracket \cdot \rrbracket^h$. These values intuitively correspond to the contents that are explicitly mentioned in the phonological form of the complement, as exemplified in the following (we have equivalent highlighted propositions for the corresponding matrix clauses).

- (30) a. $\llbracket \text{whether it is raining} \rrbracket^h = \{\text{it is raining}\}$
 b. $\llbracket \text{whether it is raining or not} \rrbracket^h = \{\text{it is raining}, \neg \text{it is raining}\}$
 c. $\llbracket \text{whether Jo likes coffee}\uparrow \text{ or tea}\downarrow \rrbracket^h = \{\text{Jo likes coffee}, \neg \text{Jo likes tea}\}$
 d. $\llbracket \text{that it is raining} \rrbracket^h = \{\text{it is raining}\}$

Their analysis of answer particles states that, for instance, *yes* (a) presupposes that there is exactly one proposition highlighted by the preceding question and (b) affirms this unique proposition if the presupposition is satisfied. This captures the fact that *yes* is a felicitous response to polar questions, such as *Is it raining?*, which highlights exactly one proposition, but not to a PolQvN, such as *Is it raining or not?* and AltQs, such as *Does Jo like coffee or tea?*, which highlight more than one propositions. I will not delve into the details of their analysis of answer particles here. The reader is referred to the relevant discussion in Pruitt and Roelofsen (2011) as well as in Pruitt and Roelofsen (2013), Roelofsen and Farkas (2015) and Farkas and Roelofsen (2019) for refinements and cross-linguistic extensions of the analysis of answer particles based on the notion of highlighting. See also Theiler’s (2020) analysis of the German discourse particle *denn* as an additional empirical motivation for highlighting.

What’s important for our purposes is that Pruitt and Roelofsen (2011) present the interpretation of *doubt* as another empirical motivation for the need for highlighting. They argue that the interpretation of *doubt-whether* calls for an analysis where its semantics is sensitive to the proposition highlighted by its complement. Their argument is based on pairs of examples such as the following:

- (31) a. John doubts whether the door is open.

b. John doubts whether the door is closed.

(Pruitt and Roelofsen, 2011: 27, (73))

(32) a. Ann doubts whether they serve breakfast.

b. Ann doubts whether they don't serve breakfast.

Specifically, Pruitt and Roelofsen observe that the a-example and the corresponding b-example in pairs such as the above differ in their truth conditions. For example, if John suspects that the door is open, (31b) can be true but (31a) cannot. Similarly, in a situation where Ann suspects that they serve breakfast, (32b) can be true but (32a) cannot. If *doubt* is only sensitive to the ordinary-semantic value of the complement, the truth-conditional differences cannot be accounted for, as $\llbracket \text{whether } p \rrbracket^o = \llbracket \text{whether not-}p \rrbracket^o$. However, if *doubt* is sensitive to the highlighted content, the difference is accounted for, since $\llbracket \text{whether } p \rrbracket^h \neq \llbracket \text{whether not-}p \rrbracket^h$.

How does the analysis fare with Dixon's observations regarding the difference between *doubt-that* and *doubt-whether*? Since Pruitt and Roelofsen (2011) do not present a concrete lexical entry for *doubt*, it is difficult to evaluate their predictions in this regard. However, unlike Biezma and Rawlins (2012), their claim is at least compatible with the possibility that *doubt-that* and *doubt-whether* differ in interpretations. This is so because *doubt* may be sensitive to the ordinary-semantic value (where $\llbracket \text{that } p \rrbracket^o \neq \llbracket \text{whether } p \rrbracket^o$) in addition to the highlighted value. Then again, it is left open how such an analysis can be implemented in a concrete lexical entry. For this reason, Pruitt and Roelofsen (2011) fail to achieve our second desideratum, i.e., the precise semantic analysis of *doubt*. In addition, just as in the case of Biezma and Rawlins (2012), the incomplete nature of their semantic analysis leaves open how much they are successful in explaining the selectional restriction of *doubt* in terms of its lexical semantics.

4 Proposal

In this section, I will propose a concrete semantic analysis of *doubt* with the aim of achieving an account that satisfies the three desiderata I have set out in §2. As a reminder, I restate the three desiderata in the following:

1. **Selectional restriction:** The analysis has to capture the selectional restriction of *doubt*, i.e., its compatibility with declarative and PolQ complements, and its incompatibility with other types of complements.
2. **Interpretation:** The analysis has to account for the interpretation of *doubt*, including the following observations from Dixon (2005):
 - $\lceil \text{doubt that } p \rceil$ suggests that *p* has been asserted in the context while $\lceil \text{doubt whether } p \rceil$ only suggests that the idea of *p* 'has been floated'
 - $\lceil \text{not doubt that } p \rceil$ leads to the inference that the subject believes *p* while $\lceil \text{not doubt whether } p \rceil$ is degraded.

3. **Meaning-driven analysis of the cross-linguistic pattern:** The semantics of *doubt* has to be such that it accounts for the cross-linguistically general pattern of selectional restrictions exhibited by dubitative predicates, i.e., their compatibility with declarative and answer-mentioning interrogative complements and their incompatibility with constituent *wh*-complements.

As I briefly mentioned in §2, I will not attempt to provide an in-depth analysis of the cross-linguistic variation in selectional restrictions observed in §2.2.

4.1 The baseline analysis: $\neg\Box p$

A challenge in formulating a semantic analysis of *doubt* that satisfies the second desideratum concerns how to reconcile the analytical intuition (after Karttunen 1977b) that $\lceil \textit{doubt that } p \rceil$ and $\lceil \textit{doubt whether } p \rceil$ are near-synonymous on the one hand and Dixon’s observations about the fine-grained differences between *doubt-that* and *doubt-whether* on the other. To meet this challenge, I will employ the distinction between the ordinary value and the highlighted value along the lines of Pruitt and Roelofsen (2011) and argue that *doubt* is sensitive to both dimensions of the complement meaning. Since the highlighted value is the same for $\lceil \textit{that } p \rceil$ and $\lceil \textit{whether } p \rceil$, the aspect of the meaning of *doubt* that is sensitive to the highlighted value will be synonymous between $\lceil \textit{doubt that } p \rceil$ and $\lceil \textit{doubt whether } p \rceil$. In contrast, since the ordinary values are different between $\lceil \textit{that } p \rceil$ and $\lceil \textit{whether } p \rceil$, the fine-grained difference between $\lceil \textit{doubt that } p \rceil$ and $\lceil \textit{doubt whether } p \rceil$ can be captured by the aspect of the meaning which is sensitive to the ordinary value.

Another important challenge concerns the interaction with negation: how can we derive the strong inference that the attitude holder believes the complement when *doubt-that* is negated? One analytical option to meet this challenge is to adopt an existential semantics for *doubt*, following a similar suggestion by Anand and Hacquard (2013).²³ That is, roughly, $\lceil x \textit{ doubt that } p \rceil$ expresses that *x* considers $\neg p$ possible ($\Diamond\neg p$). Or, equivalently, it is not the case that *x* believes *p* ($\neg\Box p$). When this is negated, we have: *x* believes *p* ($\Box p$)

This idea is made concrete in the following baseline entry for *doubt*, which involves two presuppositional conditions in addition to the existential doxastic attitude in the assertive component. Ultimately, I will identify two issues with this analysis and propose a refinement based on exhaustification. However, for ease of exposition, I will first discuss to what extent the baseline analysis meets our desiderata for the analysis of *doubt*. The discussion of the issues and the exhaustification-based refinement will be given later in §4.4.

(33) Lexical entry for *doubt*²⁴

²³See also Močnik (2017) and Močnik and Abramovitz (2019) for existing proposals to analyze attitudinal predicates (specifically Slovenian *dopuščati* and Koryak *lvək*) as involving existential quantification over worlds compatible with the attitude holder’s information state.

²⁴In this paper, to avoid clutter, I will use variables *x* and *p* for both an object language expression and their model-theoretic counterparts.

- $\llbracket x \text{ doubts } \varphi \rrbracket^o(w)$ presupposes:
 - (i) $\llbracket \varphi \rrbracket^o \in \text{table}$; and
 - (ii) $\forall p \in \llbracket \varphi \rrbracket^o : \text{DOX}_x^w \cap p \neq \emptyset$
- If the above presuppositions are met,

$$\llbracket x \text{ doubts } \varphi \rrbracket^o(w) = 1 \text{ iff } \text{DOX}_x^w \not\subseteq \bigcup \llbracket \varphi \rrbracket^h$$

Here, *table* refers to the CONVERSATIONAL TABLE in the model of discourse by Farkas and Bruce (2010) and Farkas and Roelofsen (2017), i.e. the stack of proposals made so far in the conversation. Here, a proposal can either be a statement that has been asserted by a conversational participant or a question which has been raised. Either case, a proposal is modelled as a set of propositions, where a statement is a singleton proposition-set and a question is typically a non-singleton set.

Given the assumptions laid out in §3.2, the entry in (33) can be rewritten as follows for a declarative complement $\lceil \text{that } p \rceil$ and a PolQ complement $\lceil \text{whether } p \rceil$:

- (34) a. • $\llbracket x \text{ doubts that } p \rrbracket^o(w)$ presupposes:
- (i) $\{p\} \in \text{table}$; and
 - (ii) $\text{DOX}_x^w \cap p \neq \emptyset$
- If the above presuppositions are met,
 $\llbracket x \text{ doubts that } p \rrbracket^o(w) = 1 \text{ iff } \text{DOX}_x^w \not\subseteq p$
- b. • $\llbracket x \text{ doubts whether } p \rrbracket^o(w)$ presupposes:
- (i) $\{p, \bar{p}\} \in \text{table}$; and
 - (ii) $\forall p' \in \{p, \bar{p}\} : \text{DOX}_x^w \cap p' \neq \emptyset$
- If the above presuppositions are met,
 $\llbracket x \text{ doubts whether } p \rrbracket^o(w) = 1 \text{ iff } \text{DOX}_x^w \not\subseteq p$

4.2 The asserted meaning and presuppositions

I illustrate the analysis starting from the assertive component. As suggested above, the entry analyzes $\lceil \text{doubt that/whether } p \rceil$ as asserting an existential doxastic attitude toward the negation of the highlighted value of $\lceil \text{that/whether } p \rceil$. At this assertive level, $\lceil \text{doubt that } p \rceil$ and $\lceil \text{doubt whether } p \rceil$ are equivalent, thanks to the fact that $\llbracket \text{that } p \rrbracket^h = \llbracket \text{whether } p \rrbracket^h = \{p\}$. This captures the analytical intuition due to Karttunen (1977b) that *doubt-that* and *doubt-whether* are equivalent at some level. Furthermore, this also captures the observation that the negation of $\lceil \text{doubt that } p \rceil$ entails the subject's belief of p . For, the negation of $\text{DOX}_x^w \not\subseteq p$ is simply $\text{DOX}_x^w \subseteq p$. Now, how can we then capture the unacceptability of the negation of *doubt-whether*? This is due to the interaction between the assertive meaning and the presuppositions, to which I now turn.

According to the analysis presented above, $\lceil \text{doubt that/whether } p \rceil$ has two presuppositions: (i) the ordinary value of the complement is on the conversational table; and (ii) every proposition in the ordinary value of the complement

is compatible with the subject’s doxastic state. The first presupposition captures Dixon’s (2005) observation that ‘*doubt that p*’ presupposes that someone has already asserted *p* while ‘*doubt whether p*’ only presupposes that the idea of *p* has been ‘floated’. In the declarative case, the ordinary value of the complement, i.e. $\{p\}$, is presupposed to be on the conversational table. In contrast, in the PolQ case, the relevant value is $\{p, \bar{p}\}$. So, the presupposition amounts the requirement that the issue of whether *p* or not has been on the conversational table (which does not require anyone to have asserted *p*). I submit that this is an appropriate formal rendering of Dixon’s observations.

Moving on to the the second presupposition, it states that the complement proposition is compatible with the subject’s beliefs in the case of declarative complements while it states that both the positive and the negative resolution are compatible with the subject’s beliefs in the case of PolQ complements. In the latter case, the presupposition amounts to the subject’s uncertainty about the issue expressed by the complement. This uncertainty condition is intuitively reasonable, and has precedence in the analysis of *doubt* by Anand and Hacquard (2013) (although Anand and Hacquard do not discuss *doubt-whether*). In addition, it has the further benefit of predicting the unacceptability of *not-doubt-whether* when it is taken together with the assertion. To see this, consider the prediction for the interpretation of ‘*x does not doubt whether p*’ below:

- (35) • $\llbracket x \text{ does not doubt whether } p \rrbracket^o(w)$ presupposes:
- (i) $\{p, \bar{p}\} \in \text{table}$; and
 - (ii) $\forall p' \in \{p, \bar{p}\} : \text{DOX}_x^w \cap p' \neq \emptyset$
- If the above presuppositions are met,
 $\llbracket x \text{ does not doubt whether } p \rrbracket^o(w) = 1$ iff $\text{DOX}_x^w \subseteq p$

Here, the second presupposition contradicts the assertion, explaining the unacceptability. Note that the same issue does not arise with ‘*x does not doubt that p*’ since its second presupposition only amounts to *x*’s beliefs being compatible with *p*, which is consistent with the predicted assertion that *x* believes *p*.

4.3 Selectional restrictions

Let us now see how the analysis captures the selectional restriction of *doubt* and whether the account predicts the cross-linguistically general selectional restriction for dubitative predicates. I have already illustrated that *doubt* as analyzed above is compatible with both declarative and PolQ complements (except when the PolQ case is negated). On the other hand, the analysis correctly predicts that the verb is incompatible with constituent *wh*-complements, given that the highlighted value only includes the answers that are *mentioned* in the syntactic form of the complement. That is, roughly, since no answer of ‘*who has passed the test*’ is highlighted, the assertion of ‘*doubt who has passed the test*’, which depends on the highlighted value of the complement, is predicted to have a pathological meaning.

Technically, we can formalize this analysis by assuming that the highlighted value of a constituent *wh*-complement is the empty set:²⁵

$$(36) \llbracket \text{who has passed the test} \rrbracket^h = \emptyset$$

As a result, the assertive component of $\lceil x \text{ doubts } who... \rceil$ will be $\text{DOX}_x^w \not\subseteq \emptyset$.²⁶ This is trivially true given the second presupposition, which states that DOX_x^w is compatible with each answers of the complement. Assuming that unacceptability ensues from this type of logical triviality (e.g., Gajewski, 2002, 2009, Schwarz and Simonenko, 2018, Del Pinal, 2019, Chierchia, 2019), this accounts for the incompatibility between *doubt* and constituent *wh*-complements.

With additional assumptions about highlighting, the analysis also accounts for the incompatibility between *doubt* and PolQvN and AltQ complements. The relevant assumption about PolQvN complements (which follows from the general idea that the highlighted value includes those answers that are mentioned by the complement) is that they highlight both positive and negative answer, as follows:

$$(37) \llbracket \text{whether or not it is raining} \rrbracket^h = \{\text{it is raining, it is not raining}\}$$

This again predicts contradiction when combined with the proposed semantics for *doubt*. Here is why: since $\text{DOX}_x^w \not\subseteq \bigcup \{p, \neg p\} \iff \text{DOX}_x^w \not\subseteq W$ (where W is the set of all worlds), the highlighted value of the complement in (37) predicts that the assertion of *doubt* + AltQvN is always contradictory.

As for the AltQ complement, we have a similar explanation but with an additional assumption regarding an existential presupposition projected by the complement. Similarly to the PolQvN case above, we assume a two-membered highlighted value for an AltQ, as follows:

$$(38) \llbracket \text{whether they serve coffee}\uparrow \text{ or tea}\downarrow \rrbracket^h \\ = \{\text{they serve coffee, they serve tea}\}$$

This will then give rise to the following asserted meaning for *doubt*-PolQvN: the attitude holder's doxastic state is compatible with them serving neither coffee nor tea. But, this contradicts the projection of the existential presupposition associated with AltQ, i.e., the presupposition that they serve either coffee or tea projected to the attitude holder's doxastic state.

Note that the analysis utilizes different assumptions about the highlighted value in the account of the incompatibility with constituent *wh*-complements and in the account of that with PolQvN and AltQ-complements. The former

²⁵Another option is to follow Roelofsen et al. (2019) and Roelofsen (2019) and assume that the highlighted value of an interrogative complement is its ABSTRACT in Groenendijk and Stokhof's (1984) sense. Under this assumption, we have the following value for the highlighted value of a constituent *wh*-complement:

$$(i) \llbracket \text{who has passed the test} \rrbracket^h = \{\lambda x_e \lambda w_x. \text{PassedTheTest}_w(x)\}$$

In this case, the assertive component of $\lceil x \text{ doubts } who... \rceil$ will be undefined because it is defined only if the members of the highlighted value of the complement is a set of worlds.

²⁶This is because $\bigcup \emptyset = \emptyset$.

assumes that the constituent *wh*-complement lacks a highlighted proposition while the latter assumes that the highlighted value of the PolQvN/AltQ exhausts the logical space (given presupposition). I suggest that this is the key to the account of the cross-linguistic generalization and variation in the selectional restriction.

On the one hand, it is a cross-linguistically general feature of constituent *wh*-complements that they do not mention or highlight any specific answer. This leads to the cross-linguistic fact that dubitative predicates are incompatible with constituent *wh*-complements. On the other hand, there may in principle be language variation in the highlighted values of answer-mentioning interrogative complements. In particular, it is possible that complements that superficially resemble PolQvN or AltQ in certain languages do not have two-membered highlighted values which exhaust the (presupposed) logical space. For example, as briefly discussed in §2.2, Mandarin A-not-A questions, as exemplified in (12b) repeated from above, may only contain the positive answer in its highlighted value.

- (12b) xiaohuang **huaiyi** [xiaotang shi-bushi xihuan xiaoqiang].
 Huang doubt Tang be-NEG.be like Qiang
 ‘Huang doubts whether Tang likes Qiang’ (Huang, 2020: 6)

This accords with Hagstrom’s (2006) analysis of the A-not-A question, which essentially treats the negative morpheme as an exponent of the polar question operator. Another piece of evidence against treating A-not-A questions on a par with English PolQvNs is suggested by Huang (2020), who observes that matrix A-not-A questions do not possess the ‘cornering effect’, which is characteristic of English PolQvNs (Biezma and Rawlins, 2012). Although I will not delve into analyses of individual complement types in each language, I suggest that the acceptability of PolQvN/AltQ complements under dubitative predicates in some languages considered in §2.2 is due to a similar reason, i.e., the relevant complement types highlight only a specific answer of the complement.

This line of analysis allows us to meet number 2 and 3 of the desiderata I have posited. Combining the lexical entry of *doubt* together with the English-specific assumptions about the highlighted values of complement types leads to correct predictions about the selectional restriction. Moreover, the analysis predicts that complementation under a dubitative predicate is possible only if the complement has a non-empty highlighted value. This entails that, cross-linguistically, a constituent *wh*-complement is not possible under dubitative predicates, as it is a cross-linguistically general feature of this type of complement that they do not highlight a specific answer. At the same time, the analysis leaves open the possibility that languages may vary with respect to which types of answer-mentioning interrogative complement are allowed under a dubitative predicate. Specifically, languages may differ as to whether a complement type possesses a highlighted value which exhausts the (presupposed) logical space, leading to variation in the possibility of the complement type under a dubitative predicate.

4.4 Exhaustification

So far, I have discussed the baseline analysis of *doubt* based on the idea that the predicate expresses an existential doxastic attitude. The lexical entry is repeated below:

- (33) • $\llbracket x \text{ doubts } \varphi \rrbracket^o(w)$ presupposes:
- (i) $\llbracket \varphi \rrbracket^o \in \text{table}$; and
 - (ii) $\forall p \in \llbracket \varphi \rrbracket^o : \text{DOX}_x^w \cap p \neq \emptyset$
- If the above presuppositions are met,
 $\llbracket x \text{ doubts } \varphi \rrbracket^o(w) = 1$ iff $\text{DOX}_x^w \not\subseteq \bigcup \llbracket \varphi \rrbracket^h$

However, there are two significant problems with this entry. One is that the unembedded assertion of $\ulcorner x \text{ doubts } \varphi \urcorner$ intuitively feels stronger than just the existential statement that x 's doxastic state is compatible with not- φ . The intuition is rather that the subject considers it *likely* that φ is false, as argued by, e.g., Anand and Hacquard (2013). The other problem is a rather significant one. The entry predicts that the assertion of *doubt-whether* is entailed by its presupposition (specifically the second presupposition). If x 's beliefs are compatible with all members of the ordinary value of *whether* p (i.e., p and not- p), then it follows that x 's beliefs are compatible with not- p .

Both problems are addressed if we replace the assertive component of $\ulcorner \text{doubt-that/whether-}p \urcorner$ with a stronger claim, for example, that the attitude holder considers not- p more likely than p . Not only does this capture the intuition that an unembedded *doubt*-sentence asserts more than just compatibility between the attitude holder's beliefs and not- p , but it also makes the assertion of *doubt-whether* stronger than its presupposition. Nevertheless, if we simply replace the assertive component in our lexical entry in (33) with the comparative statement, we will lose our account of the verb's interaction with negation. Clearly, it does not follow from ' x doesn't consider not- p more likely than p ' that x believes p . Moreover, the negation of the comparative assertion does not contradict the second presupposition in the case of *doubt-whether*, making it impossible to account for the unacceptability of *not-doubt-whether*.

At this point, existing literature on exhaustification provides a crucial insight. What's relevant in particular is the recent studies on scaleless modal and attitudinal elements due to Deal (2011), Jeretič (2020) and Mirrazi and Zeijlstra (2021). In these studies, it is argued that certain modal/attitudinal statements (e.g., *ba'iji* in Ecuadorian Siona and negated attitudes in English) are strengthened due to exhaustification, given that there is no stronger scalemate (based on a mechanism proposed by Fox 2007, Bar-Lev and Fox 2020). To illustrate the analysis schematically, let us assume that we have a language in which there is an existential modal \diamond but not a scalemate necessity modal. In this language, applying exhaustification to a sentence of the form ' $\diamond p$ ' results in a necessity statement. Formally, this is analyzed as follows, with Bar-Lev and Fox's (2020) exhaustification operator based on both innocent exclusion (IE)

and innocent inclusion (II).²⁷ Following Jeretič (2020), the exhaustification is assumed to trigger subdomain alternatives, i.e., alternatives for the prejacent with subdomains of modal quantification. Here, I write $\diamond_C(p)$ as a shorthand for $\exists w \in C[p(w)]$, where C is the modal base of the possibility statement.

$$\begin{aligned}
(39) \quad & \llbracket \text{EXH}^{\text{IE}+\text{II}} \rrbracket (\{\diamond_{\{w1\}}p, \diamond_{\{w2\}}p, \diamond_{\{w1,w2\}}p\}) (\diamond_{\{w1,w2\}}p) \\
& = \diamond_{\{w1\}}p \wedge \diamond_{\{w2\}}p \wedge \diamond_{\{w1,w2\}}p \\
& \Leftrightarrow \Box_{\{w1,w2\}}p
\end{aligned}$$

This holds because all of the subdomain alternatives are not IE but are II, and hence has to be conjoined to the prejacent as the result of the exhaustification. Crucially, the set of alternatives does not include the stronger scalemate $\Box_{\{w1,w2\}}p$. If it were included, the exhaustification would predict the conjunction of the prejacent and the negation of $\Box_{\{w1,w2\}}p$ without inclusion of the subdomain alternatives.

I suggest that the same process applies in the case of *doubt-that/whether*. That is, the assertion of *doubt-that/whether* predicted by the lexical entry in (33) is equivalent to the possibility statement: there is a world in x 's doxastic state in which p is false. This possibility statement is strengthened by the exhaustification mechanism, due to (a) the presence of the subdomain alternatives corresponding to subsets of the doxastic state and (b) the lack of a stronger scalemate, i.e., an English predicate that expresses the attitude holder's belief in the negation of the complement. This resolves the two problems identified with our lexical entry for *doubt*. The exhaustification gives rise to an interpretation that is stronger than a simple existential doxastic statement, making the prediction align with our intuitions. Also, with the exhaustification, the assertion is now strictly stronger than the second presupposition in the case of *doubt-whether*.

There is, however, one glitch in the analysis. If the exhaustification derived a necessity statement that x believes not- p , it would now contradict the second presupposition, that x considers p possible. Fortunately, there is a known solution to the general issue of how to constrain exhaustification when it seems to predict readings that are too strong. In his exhaustification-based account of homogeneity, Bar-Lev (2020) analyzes the non-maximal reading of definite plurals based on PRUNING of alternatives. That is, the set of alternatives can be reduced to those that are plausible and relevant in the context, giving rise to a weaker exhaustified reading. Specifically, I follow Mirrazi and Zeijlstra (2021) in assuming that singleton subdomain alternatives can in principle be pruned

²⁷The relevant exhaustification operator is defined as follows:

- (i) $\llbracket \text{EXH}^{\text{IE}+\text{II}} \rrbracket (C)(p) := \lambda w. \forall q \in \text{IE}(p, C)[\neg q(w)] \wedge \forall r \in \text{II}(p, C)[r(w)]$
 - a. $\text{IE}(p, C)$
 $:= \bigcap \{C' \subseteq C \mid C' \text{ is a max. subset of } C \text{ s.t. } \{\neg q \mid q \in C'\} \cup \{p\} \text{ is consistent}\}$
 - b. $\text{II}(p, C) :=$
 $\bigcap \{C' \subseteq C \mid C' \text{ is a max. subset of } C \text{ s.t. } \{r \mid r \in C'\} \cup \{p\} \cup \{\neg q \mid q \in \text{IE}(p, C)\} \text{ is consistent}\}$

For my purposes, the same results can be obtained by recursive exhaustification in the sense of Fox (2007).

in the exhaustification of a possibility statement, deriving a non-necessity reading. Below, this is exemplified using the modal base including three worlds: $\{w1, w2, w3\}$ (the alternatives with the strike-through indicates the pruned alternatives):

$$(40) \quad \begin{aligned} & \llbracket \text{EXH}^{\text{IE}+\text{II}} \rrbracket (\{\cancel{\diamond_{\{w1\}}p}, \cancel{\diamond_{\{w2\}}p}, \cancel{\diamond_{\{w3\}}p}, \diamond_{\{w1, w2\}}p, \diamond_{\{w2, w3\}}p, \diamond_{\{w3, w1\}}p, \\ & \quad \diamond_{\{w1, w2, w3\}}p\}) (\diamond_{\{w1, w2, w3\}}p) \\ & = \diamond_{\{w1, w2\}}p \wedge \diamond_{\{w2, w3\}}p \wedge \diamond_{\{w3, w1\}}p \wedge \diamond_{\{w1, w2, w3\}}p \end{aligned}$$

The resulting reading in (40) is stronger than the prejacent, but is weaker than a necessity statement, due to the pruning of the singleton subdomain alternatives. I suggest that such pruning obligatorily happens in the case of ‘*doubt that/whether* φ^\top ’, due to the presence of the second presupposition.

All in all, we predict the following interpretations for ‘*x doubt-that/whether* p^\top ’ with exhaustification. Recall that it is assumed that the subdomain alternatives (corresponding to subsets of DOX_x^w) are triggered by $\text{EXH}^{\text{IE}+\text{II}}$, which become its first argument. Again, $\diamond_C(p)$ is a shorthand for $\exists w \in C[p(w)]$. Also, $\text{SubD}_{\text{ns}}(S) := \wp(S)/(\{W\} \cup \{\emptyset\})$ for ‘non-singleton subdomains’.

$$(41) \quad \begin{aligned} \text{a.} \quad & \bullet \llbracket \text{EXH}^{\text{IE}+\text{II}} [x \text{ doubts that } p] \rrbracket^o(w) \text{ presupposes:} \\ & \quad \text{(i) } \{p\} \in \text{table; and} \\ & \quad \text{(ii) } \diamond_{\text{DOX}_x^w}(p) \\ & \bullet \text{ If the above presuppositions are met,} \\ & \quad \llbracket \text{EXH}^{\text{IE}+\text{II}} [x \text{ doubts that } p] \rrbracket^o(w) \\ & \quad \Leftrightarrow \llbracket \text{EXH}^{\text{IE}+\text{II}} \rrbracket (\{\diamond_C(\bar{p}) \mid C \in \text{SubD}_{\text{ns}}(\text{DOX}_x^w)\}) (\diamond_{\text{DOX}_x^w}(\bar{p})) \\ & \quad \Leftrightarrow \bigwedge_{C \in \text{SubD}_{\text{ns}}(\text{DOX}_x^w)} [\diamond_C(\bar{p})] \\ \text{b.} \quad & \bullet \llbracket [x \text{ doubts whether } p] \rrbracket^o(w) \text{ presupposes:} \\ & \quad \text{(i) } \{p, \bar{p}\} \in \text{table; and} \\ & \quad \text{(ii) } \forall p' \in \{p, \bar{p}\} [\diamond_{\text{DOX}_x^w}(p')] \\ & \bullet \text{ If the above presuppositions are met,} \\ & \quad \llbracket \text{EXH}^{\text{IE}+\text{II}} [x \text{ doubts that } p] \rrbracket^o(w) \\ & \quad \Leftrightarrow \llbracket \text{EXH}^{\text{IE}+\text{II}} \rrbracket (\{\diamond_C(\bar{p}) \mid C \in \text{SubD}_{\text{ns}}(\text{DOX}_x^w)\}) (\diamond_{\text{DOX}_x^w}(\bar{p})) \\ & \quad \Leftrightarrow \bigwedge_{C \in \text{SubD}_{\text{ns}}(\text{DOX}_x^w)} [\diamond_C(\bar{p})] \end{aligned}$$

The addition of the exhaustification mechanism furthermore preserves our account of the interpretation of *not-doubt-that* and the degradedness of *not-doubt-whether*. It furthermore arguably improves it by allowing for flexibility in terms of the optionality of the local $\text{EXH}^{\text{IE}+\text{II}}$ insertion. Based on the general assumption that exhaustification normally only strengthens the overall meaning (Chierchia et al., 2012), in unmarked cases, $\text{EXH}^{\text{IE}+\text{II}}$ is not applied in a downward-entailing (DE) context, such as under negation. Our analysis of *not-doubt-that/whether* is carried over in such unmarked cases. However, the account also in principle allows for the possibility that $\text{EXH}^{\text{IE}+\text{II}}$ is applied under negation. I suggest that this captures marked cases of negated *doubt*-sentences, such as the following (perhaps the most natural if *doubt* is stressed):

- (42) I don't *doubt* that/whether she will win. In fact, I think her winning is reasonably likely.

Negation of the strengthened reading of *doubt-that/whether* will predict interpretations compatible with this type of data.

Furthermore, the exhaustification-based analysis also makes correct predictions about the natural interpretation of *doubt-that* in an antecedent of conditionals. This is exemplified in the following attested example from a Commercial Drivers License practice test:

- (43) **Question:** If you doubt that you have enough space to safely drive under a bridge or sign, you should ... (**Answer:** drive slowly).

Follow-up explanation: If you are not certain that your vehicle will fit under overhead objects, you should slow down and take a different route, if possible.

<https://cdl-prep.com/question/if-you-doubt-that-you-have-enough-space-to-safely-drive-under-6340465334943744>

Under the most natural interpretation of this example, *doubt* has an existential reading: $\diamond \bar{p}$, which is also clear from the paraphrase in the follow-up explanation *if you are not certain...*. This is expected under the exhaustification-based analysis since a conditional antecedent is a DE context.

Now, if $\text{EXH}^{\text{IE}+\text{II}}$ is in principle possible in a DE context, as I suggested above, we also expect the strengthened interpretation of *doubt* to be possible in an *if*-clause. I submit that this is a reasonable prediction. Yet, I have not been able to find an example that directly confirms this prediction.²⁸

²⁸The prediction can be indirectly tested by checking whether *doubt-whether* is acceptable in the antecedent of a conditional. With the non-strengthened, existential, interpretation of *doubt*, $\lceil \text{If } I \text{ doubt whether } p, q \rceil$ is predicted to be infelicitous. Here's why. The sentence is predicted to presuppose $\diamond p$ and $\diamond \bar{p}$ (given the projection of the presupposition of *doubt-whether* from the antecedent). On the other hand, the antecedent itself states $\diamond \bar{p}$ (given the non-strengthened meaning). This means that the antecedent is already entailed by the presupposition of the sentence, rendering it trivial. Assuming that a conditional with a trivial antecedent is infelicitous, we predict $\lceil \text{If } I \text{ doubt whether } p, q \rceil$ to be infelicitous with the non-strengthened reading of *doubt*. There are several examples of $\lceil \text{if } \text{doubt } \text{whether} \rceil$ on the web:

- (1) a. If I doubt whether I exist, or doubt whether I have to think in general terms, I can reflect that my doubt involves concepts, and concepts are general. <https://sites.hofstra.edu/wp-content/uploads/sites/43/2019/08/Dissatisfaction-3c.pdf>
- b. If I doubt whether I learned the material correctly, I can simply review the lecture again. <https://english.spbstu.ru/media/news/education/ipws-ipss-through-eyes-foreign-student/>
- c. I do not believe that I should be saying anything too controversial if I doubt whether it will be a good example of clarity when I come to explain to your Lordships some of the parts of the Finance Bill. <https://publications.parliament.uk/pa/ld199596/ldhansrd/vo960327/text/60327-08.htm>

Nevertheless, it is not clear to what extent these can be considered as examples involving a strengthened reading of *doubt*.

4.5 Section summary

In this section, I have proposed a lexical entry of *doubt* based on the idea that it asserts the attitude-holder’s existential doxastic attitude towards the negation of the complement (or equivalently: negation of belief of the complement). At this assertive level, *doubt* is sensitive to the highlighted value of the complement, and thus has the same interpretation with respect to declarative and PolQ complements. On the other hand, at the presuppositional level, *doubt* is sensitive to the ordinary value of the complement. Thus, the differences in interpretation between *doubt-that* and *doubt-whether* are accounted for on the basis of the presuppositions. I have also discussed how the mechanism of exhaustification derives the intuitive interpretation of ‘*doubt-that/whether*’ in unembedded contexts. Similarly to other scaleless modal/attitudinal elements discussed by Deal (2011), Jeretič (2020), Mirrazi and Zeijlstra (2021), the possibility interpretation of *doubt* undergoes strengthening due to the lack of a stronger scalemate. This account captures the fact that the strength of the interpretation of *doubt* is conditioned by the context that embeds it: in an unembedded context, *doubt* receives a strong interpretation, while in DE contexts, such as under negation or in conditional antecedents, it receives a weak, existential, interpretation.

5 Conclusions

In this paper, I have argued that the selectional and semantic properties of *doubt*, while being seemingly puzzling at first sight, can be given a proper semantic analysis by integrating the mechanisms of highlighting and exhaustification. This provides further arguments for the utility of these mechanisms in the analysis of attitudes, building on the earlier literature (Pruitt and Roelofsen 2011, Roelofsen 2019 for highlighting; Mirrazi and Zeijlstra 2021 for exhaustification). The present analysis also helps advance the ongoing research programme that aims to give meaning-driven explanations of selectional restrictions for clause-embedding predicates (Uegaki 2015, Mayr 2018, Theiler et al. 2019, Uegaki and Sudo 2019). In particular, the analysis goes beyond existing proposals within the same research programme by extending the empirical coverage to a heretofore unexplained selectional pattern (i.e., compatibility with declarative and answer-mentioning interrogative complements and incompatibility with constituent *wh*-complements) and by taking into account cross-linguistic data in evaluating the exact link between lexical semantics and selectional properties. This said, the current paper leaves much work to be done, especially with respect to the cross-linguistic aspects of the analysis. Specifically, the hypothesized generalization about the selectional restriction of dubitative predicates needs to be evaluated in a more diverse language sample. Furthermore, we need more in-depth analyses of the highlighted value for different complement types in each language, in view of different empirical phenomena that have been argued to be sensitive to highlighting, such as

answer particles, discourse particles and selectional restrictions of emotive factives. Although I have to leave these issues open, I hope to have shown that investigating even a single clause-embedding predicate offers substantial insights into the mechanisms that enter into the selectional and semantic behaviors of clause-embedding predicates and opens up avenues for further theoretical and cross-linguistic investigation of possible links between lexical semantics and selectional restrictions.

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