Questions in Discourse: an Overview*

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1 Introduction

In the past decades of research, questions have become a very prominent topic at the semantics-pragmatics interface. Certainly, they are a natural and challenging topic for any semantic theory rooted in the tradition of truth-conditional semantics (Davidson, 1967). Since questions do not seem to come with plain truth conditions, a semantic theory of the meaning of questions always needs to go one step beyond the standard derivation of truth conditions and thereby reveal aspects of meaning hidden to pure truth-conditional semantics. However, the role questions play in most recent research developments goes way beyond this. Questions have been claimed to be a crucial ingredient of discourse representation, which makes them one of the most important, or even the most important interface between grammar and pragmatics. The notion of questions appears to be indispensable for spelling out the discourse-semantic meaning of grammatical structures in natural language in certain theories following Roberts (1996). This holds even for assertions, which usually are not assigned a question component in their underlying meaning. Moreover, some semantic theories, such as *Inquisitive Semantics* (Ciardelli, 2009; Groenendijk & Roelofsen, 2009; Ciardelli et al., 2013), even take question meanings as the most basic type of meaning. On these accounts, assertions suddenly end up being treated on a par with questions and not the other way around. Given the enormous importance of questions in the recent semantic and pragmatic literature, this chapter will give a brief overview of the main semantic theories of what questions are and of how questions should be semantically represented. Particular attention is paid to the presentation and evaluation of some recent developments in theory-building, focusing on

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Inquisitive Semantics when it comes to the underlying meaning of questions and on theories based on what has been called the *question under discussion* when it comes to modeling discourse structure.

Before doing so, we will clarify some terminological issues. In general, we distinguish between meanings, which are semantic objects represented in some meta-language, on the one hand, and linguistic objects, which are represented as strings or syntactic trees, on the other. We think of questions as semantic objects, i.e., of possible meanings of linguistic objects, following Stenius (1967), Belnap & Steel (1976) and many others up to Krifka (2011). At a basic level, questions constitute speech acts aimed at requesting information, as opposed to assertions, which provide information.¹ The fundamental importance of questions in general is evidenced by the fact that the speech act, or underlying discourse function, of questions has been linguistically conventionalized in the form of interrogative clauses in most if not all natural languages. Such interrogatives occur side-by-side with other conventionalized sentence types, such as, for instance, declaratives, which prototypically grammaticalize assertions, and imperatives, which prototypically express requests for particular actions on the side of the addressee.

There are two basic types of interrogatives: *Yes/no-* or *polar interrogatives*, such as (1), by definition, request information about whether a particular state-of-affairs obtains in the world (yes) or not (no).

(1) *Did Baptiste talk about the elections?*

König & Siemund (2007) distinguish six ways in which polar interrogatives are marked: (i) special intonation patterns, (ii) interrogative particles, (iii) the addition of special tags, (iv) disjunctive-negative structures, (v) a change in the relative order of constituents and (vi) particular verbal inflection. The most common marker is interrogative prosody: In many languages, interrogatives are realized with rising final intonation, as opposed to declaratives that typically end on a falling intonation; see, e.g., Winans (2019) for Egyptian Arabic. The main exception is argued to be Chitimacha and further exceptions are Fanti (Niger-Congo, Kwa) and Grebo (Niger-Congo, Kru) as reported in Ultan (1979).

1 Some theories, cf. Krifka (2011), strive to keep a clear distinction between speech acts and semantic objects, hence, distinguishing between questions as meanings and questions as speech acts and thereby mirroring the distinction between propositions and assertions. We will not make such a terminological distinction here, because a corresponding terminology has not become customary in the literature, even though we do acknowledge that this may give rise to certain confounds.

Another common strategy involves the use of a specialized interrogative particle that distinguishes an interrogative from a declarative sentence. Question tags, in contrast, often add some bias to the question, by suggesting that speaker or addressee may have prior expectations regarding the questioned proposition or its negative polar counterpart, cf., e.g., Reese & Asher (2006), Sudo (2013). Sometimes the interrogative mood is also marked in ways that are not specific for interrogatives and which can be found in declaratives as well. A prominent case in point are disjunction markers, see AnderBois (2011) for Yucatec Maya and Winans (2019) for the role of disjunction makers in Egyptian Arabic.

In contrast, *wh-interrogatives* often contain an indefinite (*wh*-) pronoun, and normally open up a much wider and in principle unlimited space of possibilities. Here, the speaker is not only interested in whether or not a certain state of affairs happens to be true in the evaluation world. Rather, she wants to know which of a set of alternative propositions are true. The alternative propositions are formed by assigning alternative values to the indefinite (*wh*-) pronoun. For (2), such alternatives may include that Baptiste said that the elections were rigged, or that Baptiste said that the elections were very exciting, etc.

(2) *What did Baptiste say about the elections?*

Apart from the existence of some indefinite *wh*-element, mostly the same overt markers for interrogativeness are used as for polar questions. This notably holds to the exclusion of specific prosodic marking, which is less wide-spread with *wh*-interrogatives as compared to polar interrogatives. For instance, there has been argued to be no intonational marking of *wh*-interrogatives in Tagalog and Japanese. In other languages, such as Amharic and English, intonational marking of *wh*-interrogatives seems to be optional, cf. Ultan (1979). See also Herrmann et al. (2019) for manual (syntactic) and non-manual (prosodic) markers of *wh*-interrogatives in German Sign Language (DGS).

In this overview chapter, we will be mainly concerned with questions as semantic objects, rather than with interrogatives as syntactic objects. For instance, we will entertain the possibility that there are questions in the representation of discourse or grammar that are not in need of any overt linguistic realization. In fact, it is possible that most questions raised in discourse are covert, or implicit. Even if expressed overtly, not all questions are expressed as interrogatives. Other linguistic means include definite descriptions, as in *Baptiste knows* [_{DP} *the price of wine*], which has 'Baptiste knows how much the price of wine is' as its prominent reading. Such sentences are referred to as *Concealed Questions* in the literature, cf. eg. Heim (1979), Nathan (2006), Romero (2007), Aloni & Roelofsen (2011), Frana (2017). The different semantic

analyses of concealed questions agree on the fact that concealed question-DPs denote question-like objects at some level of semantic representation.² Still, as the study of abstract semantic representations and their symbolic properties typically relies on the analysis of their linguistic realization, and since interrogatives are the most direct and unambiguous way to express questions, the formal semantic study of questions as semantic objects focuses for the most part on the analysis of the meaning of interrogative clauses. For this reason, a significant part of the discussion of questions is dedicated to the study of the meaning of interrogatives, irrespective of whether questions exist independently of overt interrogatives or not.

We provide a comprehensive critical overview of selected important parts of the literature on questions. One central aim is to introduce readers with a basic knowledge of semantics and discourse pragmatics to the core ideas of question-based theories of discourse and grammar, as well as of theories of interrogatives and questions. More importantly, we wish to draw readers' attention to problems and limitations of these theories, thereby also expressing some concern and reason for caution. In this connection, it is instructive to recall that progress in scientific research mainly comes about through careful analysis within a given theoretical framework, say, truth-conditional semantics or the syntactic or computational counterparts thereof. The study of questions pushes the limits of the program of truth-conditional semantics and necessitates the development of new analytical tools, such as, e.g., alternatives, Structured Propositions, stacks, trees of questions, etc. Some of these are easy to justify, whereas others – as inspiring as they may be – will still have to withstand further theoretical and empirical scrutiny. In any event, the new tools will increase the expressive power of the semantic meta-language. Increased expressive power in the formal representation always brings benefits and problems. Hence, in emphasizing how much the study of explicit or implicit questions in discourse and grammar constitutes progress in the study of natural language semantics, we do not forget that new advances achieved by increasing the expressive power of the meta-language are not that surprising by themselves, and that careful study of the limitations and essential properties of the new analytical tools is important as well. This paper is not meant to close all the research gaps we identify and discuss, nor could it, whence its more modest objective of providing a mere critical overview.

2 This being so, we expect much of our general discussion of questions to carry over to concealed questions as well. This does not mean that interrogative clauses and concealed question DPs express have the same semantic range in terms of subtypes of questions. See eg. Nathan (2006) and references there for semantic differences between the two classes of linguistic objects.

The structure of this overview is as follows. In section 2, we discuss classical theories of the meaning of interrogatives as well as their general function in discourse. This includes a general discussion of the main semantic properties of interrogatives, such as, e.g., existence and exhaustivity inferences. In section 3, we turn to Inquisitive Semantics, which is an important recent semantic research framework that mainly focuses on questions. We devote an entire section to Inquisitive Semantics because its formal apparatus essentially builds on the dynamic discourse-based notions of informativeness and inquisitiveness. For this reason, Inquisitive Semantics lends itself particularly well to the formal study of questions in discourse. At the same time, being a new framework, we consider a critical perspective and comparison to older frameworks particularly important. In section 4, we turn to the role of the *question under discussion* in discourse structuring and in theories of information structure and presupposition projection. The section also discusses the limits of the framework and potential further developments. The chapter ends with some concluding remarks in section 5.

2 Classical Theories of Meaning and Function of Questions

A first starting point in the discussion of the semantics of questions is the observation that they lack truth conditions: questions cannot be true or false. Any attempt at studying question meanings, therefore, requires a – in some sense – more indirect approach. For instance, one can study the way in which questions influence the development of the future discourse in terms of potential assertions that can follow them. Another important way of studying question meanings is to consider the interpretation of interrogatives embedded under different matrix verbs in assertive main clauses, such as *to know*, *to wonder*, etc. Since such interrogative-embedding assertions do have truth conditions, it is possible to analyse the semantic contribution of interrogatives and, hence, questions in a compositional manner. In section 2.1, we start with a brief overview of the main discourse function of questions as compared to assertions. Following this, in section 2.2, we will discuss the most important formal theories of interrogative meaning, which capture the major discourse-functional effects and the truth-conditional impact of embedded interrogatives. Finally, section 2.3 will conclude the overview of overt questions with a short discussion of other semantic properties that are often associated with (wh-) interrogatives, such as existence presuppositions, exhaustivity inferences, and the semantics of *which*-questions.

2.1 *How Assertions and Questions Differ in Discourse*

It is a common assumption in both linguistic semantics and language philosophy that a central goal of the linguistic interaction between two or more speakers consists of the transfer of information to increase the jointly accessible knowledge base, and, thereby, to facilitate the coordinated exertion of interlocutors' future actions cf. Grice (1967), Lewis (1969), Stalnaker (1978) and many others. Formal models of this information-balancing approach to linguistic behavior typically involve the notions of a *discourse*, which is a sequence of two or more linguistic exchanges by two or more *discourse participants* or interlocutors, the speakers and addressees of the respective linguistic utterances. Importantly, such models also typically involve the notion of the *Common Ground (CG)*, which is a formal model of the mutually accessible knowledge base. The common ground of Stalnaker (1974, 1978, 2002) models the progress of growth in the mutually available information in the form of a successive context updating function that registers those information chunks that are first proffered and then, publicly and mutually, accepted as true by all the interlocutors in a given discourse situation. Such information chunks are typically modeled in the form of *propositions*, which are formal semantic objects allowing for reference to conceivable or possible (but not necessarily actual) states-of-affairs. As descriptions of states-of-affairs, which must necessarily obtain in some world or other, propositions characterize possible worlds. Propositions are, therefore, often modeled as characteristic functions from possible worlds to truth values: propositions yield the value '1/true' if the state-of-affairs obtains in the evaluation world, '0/false' otherwise.³ Given this conception of propositions, Stalnaker's CG consists of the set of propositions that are mutually and publicly accepted as true by the interlocutors.

To illustrate, consider the short exchange in (3), in which A proffers a personal opinion of his or hers, which is acknowledged and accepted by B.

- (3) a. A: *Blackstar is one of the best Bowie songs ever.*
 b. B: *Yes. / True. / Sure / Hmm* (acknowledging).

Crucially, for Stalnaker (1978), the original common ground CG_0 , that is, whatever A and B may have publicly and mutually agreed on before the utterance of

3 This idea can be traced back to Carnap (1947) and has been chiefly developed and defended in Hintikka (1957, 1961), Kripke (1959, 1963a,b) and others.

(3a), is only updated after B has publicly committed to the truth of A's utterance as well, resulting in CG_{1B} . The CG-update in this mini-discourse is modeled in (4):⁴

- (4) a. $CG_0 = \{\dots, \lambda w.\mathbf{friends(A, B, w)}\dots\}$ ⁵
 b. $CG_{1A} = CG_0$
 c. $CG_{1B} = CG_0 \cup \{\lambda w.\mathbf{best_Bowie_song(Blackstar, w)}\}$

This simple CG-model captures the successive increase in information that is publicly and mutually available to the interlocutors. By proffering and accepting their views on the world, that is, which states-of-affairs obtain in it, the interlocutors learn more about their world. And by obtaining factual knowledge about the world and its inhabitants, the interlocutors can exclude ever more possible worlds from the list of candidate worlds for the actual world. Stalnaker models this aspect of context update in the form of the so-called context set (cs), which is the intersection of all propositions in the CG, i.e., the set of worlds making all propositions in the CG true:

- (5) $cs_{1B} = \bigcap CG_{1B} = \{w | \mathbf{best_Bowie_song(Blackstar, w)} \wedge \mathbf{friends(A, B, w)}\dots\}$

Turning to questions, intuitively, their function in a CG-based conception of discourse is straightforward: Unlike assertions, the primary function of which consists in proffering a concrete piece of information to be accepted or rejected by the other discourse participants, the core function of questions consists in requesting a particular information in a principled and structured manner. Consider the question-answer sequence in (6):

- (6) a. A1: *What is the best Bowie song?* question
 b. B: *Black Star (is the best Bowie song).* answer
 c. A2: *I see.* acceptance

4 Our toy model is simplified in many respects. For instance, according to Stalnaker (1996) the common ground does not only contain the truth-conditional content of mutually accepted assertions, but also the knowledge that certain speech acts have been performed and the particular words, referents, etc. used in those speech acts, which is made more explicit in various versions of dynamic semantics (Kamp, 1981; Heim, 1982; Groenendijk & Stokhof, 1991). Similarly, we take it as granted that accepting an utterance does not necessarily involve a dedicated speech act. Because of this, direct updating after (3a) is also conceivable, and this often happens in discourse, cf. Farkas & Bruce (2010) for a more elaborate model.

5 As a matter of notation, we use bold face for (predicate) constants and italics for variables.

Intuitively, the question in (6a) is an explicit request for information update by the addressee. One way of modeling this idea is to assume that, by posing question (6a), the speaker opens up a range of alternative possibilities that are compatible with the information available for the addressee to pick an answer from. In (6), the answer space of possibilities is defined by the entire set of Bowie-songs that qualify – in principle – as the best according to the speaker. The addressee's answer then consists in a choice of one (or more) possible alternatives from this set, which – being asserted – is proffered for the original questioner to accept. This is shown formally in (7).

(7) Answer space of (6a):

$\{\lambda w.\text{best_Bowie_song}(\text{Heroes}, w), \lambda w.\text{best_Bowie_song}(\text{SpaceOddity}, w),$
 $\lambda w.\text{best_Bowie_song}(\text{Let'sDance}, w), \lambda w.\text{best_Bowie_song}(\text{Blackstar}, w),$
 $\lambda w.\text{best_Bowie_song}(\text{Wherearewenow?}, w)\}$

In terms of common ground update, this would amount to the situation in (8), under the assumption that a question does not provide information to enter the common ground.

- (8) a. $CG_0 = \{\dots, \lambda w.\text{singer}(\text{Bowie}, w), \lambda w.\exists x.\text{Bowie_song}(x, w) \wedge \text{likes}(B, x, w), \dots\}$
 b. $CG_{A1} = CG_0$
 c. $CG_B = CG_0$
 d. $CG_{A2} = CG_0 \cup \{\lambda w.\text{best_Bowie_song}(\text{Blackstar}, w)\}$

While this seems correct from a pure knowledge- or information-based perspective on discourse, it is certainly essential to also represent questions in general theories of discourse update. After all, the posing of a question explicitly narrows down the possible future developments of a discourse. The dialogue in (9) seems odd for the very reason that B does not address the question posed, as she is expected to. Hence, we can understand questions as filters of possible follow-up updates of the common ground in the sense that – at least in principle – a question will filter out immediate response assertions that fail to comply with the answer space provided by the question.

- (9) a. A_1 : *What is the best Bowie-song?* question
 b. B: *#I've been thinking about the new boyfriend of Natasha recently.* answer

In (10), this is modeled by representing a discourse as a tuple consisting of the common ground and a set of questions. If the set of questions is not empty,

an update will only be possible if the next utterance addresses the question, in which case the question is deleted from the set of questions.⁶

(10) Discourse update for (6)

- a. $D_0 = \langle CG_0, \emptyset \rangle$
- b. $D_{A1} = \langle CG_0, \{Q\} \rangle$
- c. $D_B = \langle CG_0, \emptyset \rangle$ question addressed and deleted
- d. $D_{A2} = \langle CG_0 \cup A2, \emptyset \rangle$

2.2 *The Meaning of Interrogatives*

This section gives a short overview of the standard approaches to the analysis of overt questions through the study of the meaning of interrogative clauses. There are three main types of approaches, namely alternative-based approaches to question semantics, discussed in section 2.2.1 and prominently defended, e.g., in Hamblin (1973), Karttunen (1977), or more recently in Beaver & Clark (2008); Partition Semantics, as developed in Groenendijk & Stokhof (1984) and recently defended in Haida (2007), discussed here in section 2.2.2; and, finally, the Structured Propositions-based approach, which we briefly discuss in 2.2.3 cf. e.g. Hausser & Zaefferer (1979), von Stechow & Zimmermann (1984), Ginzburg (1992), Reich (2001, 2002), Krifka (2001, 2004) and many others. All three approaches appear to agree on a very basic intuition, namely that the meaning contribution of questions is best understood in terms of what constitutes a good answer, or in more conceptual terms:

One knows the meaning of an interrogative sentence if one knows, given the circumstances, what counts as a true answer to that question. Since, however, this ought to be perfectly general, that is, since one should be supposed to know what would be a true answer in all possible circumstances, this means that the meaning of questions really resides in its answerhood *conditions*.

DEKKER et al., 2007 p. 6.

Hence, all the major semantic approaches to question semantics incorporate in their formal modeling the notion of a logical space of possibilities, or answer

⁶ In fact, modeling the representation of questions in discourse together with their constraints on possible discourse continuations is way more complicated than this toy model would suggest. Various theories starting from Ginzburg (1992) and Roberts (1996) and up to Farkas & Bruce (2010), Ginzburg (2012) or Onea (2016) have been proposed. Some of these will be discussed later in this chapter.

alternatives for the addressee to choose from. The core function of questions in CG-management as opening up an answer space is thus appropriately reflected in their formal semantic analysis. As will emerge in the present sub-section, the question meaning of interrogatives is derivable in compositional fashion by means of a (sometimes covert) question operator in the left periphery of the interrogative.

2.2.1 Alternative-Based Approaches

Two prominent analyses of overt questions in terms of semantic alternatives are found in Hamblin (1973) and Karttunen (1977). Following an early analysis in Hamblin (1958), both authors define overt questions as the set of propositions that function as (possible) answers to the question. Unlike in Hamblin (1958), however, the possible answers need not be mutually exclusive.

Hamblin (1973) conceives of the meaning of interrogatives as the set of all possible answers, true or false. As a result, the semantic import of overt questions is independent of the actual state of affairs in the utterance world. For illustration, the meaning of the polar interrogative (11a) is shown in (11b), which is the set consisting of the proposition expressed and its negated counterpart. The meaning of the *wh*-interrogative in (12a) is given in (12b) and (12c), where (12c) is the general representation of the question meaning in the absence of information on the concrete list of individuals in the discourse domain:⁷

- (11) a. *Does Baptiste have a favorite Bowie song?*
 b. $\llbracket(11a)\rrbracket = \{\lambda w.\exists x.\text{fav_Bowie_song}(x, \text{Baptiste}, w),$
 $\lambda w.\neg\exists x.\text{fav_Bowie_song}(x, \text{Baptiste}, w)\}$
- (12) a. *Who does Baptiste listen to? (i.e., which singers)*
 b. $\llbracket(12a)\rrbracket = \{\lambda w.\text{listen}(\text{Baptiste}, \text{Bowie}, w),$
 $\lambda w.\text{listen}(\text{Baptiste}, \text{Johnny_Cash}, w),$
 $\lambda w.\text{listen}(\text{Baptiste}, \text{FatBoySlim}, w)\}$
 c. $\llbracket(12a)\rrbracket = \{p|\exists x.p = \lambda w.\text{listen}(\text{Baptiste}, x, w)\}$

⁷ For presentational purposes, we will ignore the contribution of plural semantics throughout this chapter. Generally, it is assumed that alternatives should in most cases not only include atomic individuals but also plural sum-individuals. Readers can easily reconstruct the denotations using sum-individuals by applying the necessary closure operations under sum-formation, cf. Link (1983) and the discussion in Lahiri (1991) for application to interrogatives.

For Hamblin, the meanings in (11b) and (12b) are constant across different evaluation worlds, independently of whether or not Baptiste has a favorite Bowie-song, and which one it is. Because of this, the world-index on the interpretation function can be omitted. Moreover, (12c) shows the import of the variable introduced by the indefinite interrogative pronoun in the form of an existential quantifier. Finally, since the propositions involved in question formation are functions of type $\langle s, t \rangle$, the semantic type of questions will be of type $\langle \langle s, t \rangle, t \rangle$, as these are sets of propositions or characteristic functions thereof. Given some basic proposition, such sets of propositions can be compositionally derived by assuming the question operators in (13a) and (13b) for polar interrogatives and wh-interrogatives, respectively, cf. Karttunen (1977, p. 10). While the derivation of polar questions is straightforward, the compositional derivation of wh-questions requires an additional step of predicate abstraction over the semantic slot filled by the indefinite variable (here of unspecified variable type σ), before the Q_{WH} -operator can apply:

- (13) a. $\llbracket Q_{POL} \rrbracket = \lambda q_{\langle s, t \rangle} . \lambda p_{\langle s, t \rangle} . p = q \vee p = \neg q$
 b. $\llbracket Q_{WH} \rrbracket = \lambda P_{\langle \sigma, \langle s, t \rangle \rangle} . \lambda p_{\langle s, t \rangle} . \exists x_{\sigma} . p = P(x)$

In line with Hamblin, Karttunen (1977) also analyses wh-interrogatives as denoting sets of propositions. Contrasting with Hamblin's analysis, however, the meaning of wh-interrogatives is restricted to the set of just those propositions that are true answers in a given context, and which 'jointly constitute a true and complete answer to the question' (Karttunen, 1977, p. 20); see also Belnap (1982). In this analysis, any proposition in the overt question meaning qualifies as a felicitous partial answer to the question in its own right. Such question meanings are weakly exhaustive in the sense that they constitute a complete list of all the true answers to the question in a given context, but no information over and beyond that. To illustrate, consider again the polar interrogative in (11a) and the wh-interrogative in (12a) when uttered in a world w_0 , in which Baptiste does have a favorite Bowie song, and in which he listens to Bowie and Johnny Cash, but not to FatBoy-Slim. On Karttunen's analysis, the two interrogative sentences have the formal semantic representation (question meaning) in (14a) and (14b), respectively.

- (14) a. $\llbracket (11a) \rrbracket^{w_0} = \{ \lambda w . \exists x . \text{fav_Bowie_song}(x, \text{Baptiste}, w) \}$
 b. $\llbracket (12a) \rrbracket^{w_0} = \{ \lambda w . \text{listen}(\text{Baptiste}, \text{Bowie}, w),$
 $\quad \lambda w . \text{listen}(\text{Baptiste}, \text{Johnny_Cash}, w) \}$

The abstract interpretations of polar and wh-interrogatives are shown in (15). Polar interrogatives, here indicated as $?q$, denote singleton sets that contain the single proposition of the opposition pair that is true in the evaluation world w , as in (15a). Wh-interrogatives denote all those propositions with alternative values for the wh-pronoun that are true in the evaluation world w , cf. (15b); cf. Karttunen (1977, p. 16, 20). The notation $q(x_i)$ in (15b) stands for a proposition containing a variable bound by the wh-pronoun. Binding is achieved by a process of wh-quantification, as wh-pronouns denote existential generalized quantifiers on Karttunen's analysis:

- (15) a. $\llbracket ?q \rrbracket^{w_0} = \lambda p_{\langle s, t \rangle}. p(w_0) = 1 \wedge (p = q \vee p = \neg q)$
 b. $\llbracket ?wh_i - q(x_i) \rrbracket^{w_0} = \lambda p_{\langle s, t \rangle}. \exists x. p(w_0) = 1 \wedge (p = [\lambda x_i. q(x_i)](x))$

The semantic representations in (15) make reference to evaluation worlds w_0 , as the meaning of interrogative sentences, i.e., the open question in (15b), depends crucially on the concept of truth of a proposition relative to some evaluation world. The main empirical motivation for Karttunen to restrict the meaning of wh-interrogatives to the set of true answers comes from the behavior of sentences with embedded interrogatives, such as (16) (Karttunen, 1977, p. 9):

- (16) [*Whether Mary comes to the party*] depends on [*who invites her*].

The crucial observation here is that Mary's coming to the party in a given world depends only on who actually invites her in that world, and not on who could invite her in principle. The latter interpretation would follow from Hamblin's account, according to which the meaning of the embedded wh-interrogative who invites her is the set of all possible answers, true or false. As this reading is not attested, Karttunen concludes that the set of propositions constituting an overt question should only contain the true answers to that question. Still, both versions of the alternative based semantics of questions are prominent in the literature, in part because the problem posed by (16) for the Hamblin-style semantics of questions may be solved by a more elaborate question-embedding semantics of *to depend on*.

2.2.2 Partition Semantics

The partition-based question semantics of Groenendijk & Stokhof (1984) is also primarily based on the interpretation of embedded interrogative clauses, which is then generalized to matrix interrogatives corresponding to overt questions. The meaning of wh-interrogatives on the Partition Semantics approach

differs from the Hamblin-Karttunen interpretation both in semantic type and semantic content. In particular, interrogative clauses are no longer treated as denoting sets of propositions, but as denoting index- (or world-) dependent propositions. In this view, overt questions constitute relations between Montagovian world-time indices (Montague 1973). Such semantic objects take an evaluation index j , typically the actual world w_0 , as their first argument, and check for all possible worlds (or: indices) i whether or not i matches j concerning the state-of-affairs described by the propositional core of the question. In this way, the extensional meaning of an interrogative clause divides the set of indices, or worlds, into subsets of indices, or partition cells, the contents of which are alike with respect to the propositional core of the question: questions partition the set of possible worlds according to which states-of-affairs are true in the respective worlds, and which ones are not. According to the partition-based approach, then, the core function of questions is to set-up an alternative partition space, and to request information regarding the location of the actual world within this partition space.

The central empirical motivation for the partition-based approach comes from logical entailment patterns with *wh*-interrogatives that are embedded under matrix predicates such as *know*. Groenendijk & Stokhof (1984) show that the correct interpretation of such interrogatives does not only depend on knowing which possible answers to the embedded question are true, which is the Karttunen interpretation. Instead, the correct interpretation requires additional knowledge as to which possible answers are false as well. This claim is evidenced by the valid inference patterns in (17) and (18).

(17) Peter knows who left.

Marvin left.

Peter knows that Marvin left.

(18) Peter knows who left.

Otto did not leave.

Peter knows that Otto did not leave.

The inference pattern in (17) is predicted by the Karttunen analysis. If Peter knows who left, it follows that he also knows that Marvin left if and only if the proposition that Marvin left is true, cf. Groenendijk & Stokhof (1984, p. 84). The crucial case is (18), in which the conclusion that Peter knows that Otto did not leave also seems to follow from the premises that Peter knows who left and that Otto did in fact not leave. Following Groenendijk & Stokhof (1984), the validity of the inference in (18) is accounted for if knowing who left also implies

knowing who did not leave. This means that the meaning of the embedded wh-interrogative not only registers precise information as to who left but also as to who didn't. This is evidenced by the fact that the two statements in (19), which only differ in the polarity of the wh-interrogative, come out as equivalent:

(19) *Peter knows who left.* $\leftrightarrow$ *Peter knows who didn't leave.*

As for the formal implementation, the polar interrogative in (11a) is assigned the semantic interpretation in (20). Recall that this semantic object is of propositional type $\langle s, t \rangle$.

$$(20) \llbracket (11a) \rrbracket^{w_0} = \lambda j. [\lambda w. \exists x. \text{fav_Bowie_song}(x, \text{Baptiste}, w)(w_0) = \lambda w. \exists x. \text{fav_Bowie_song}(x, \text{Baptiste}, w)(j)]$$

This question meaning sorts through the set of possible worlds and picks out only those worlds that match the evaluation world w_0 regarding the questioned proposition. When uttered in a world w_0 in which Baptiste has a favorite Bowie song, the question meaning contains all the worlds in which this fact obtains. When uttered in a world w_1 in which Baptiste has no favorite Bowie songs, the question identifies the complementary cell of worlds in which this is so as well. For illustration, assume that the proposition $\lambda w. \exists x. \text{fav_Bowie_song}(x, \text{Baptiste}, w)$ is true at indices i_0 and i_1 , but not at i_2 , and that these are all the indices there are. In this scenario, the meaning of (11a) will differ depending on which index is chosen as the evaluation index. If the evaluation index is i_0 , the meaning of (11a) will be the set containing i_0 and i_1 , as both satisfy the proposition that Baptiste has a favorite Bowie song, but not i_2 , as shown in (21a). If the evaluation index is i_1 , the meaning of (11a) will again be the set containing i_0 and i_1 , but not i_2 , as in (21b). If the evaluation index is i_2 , however, (11a) will denote the singleton containing i_2 , for there is no other index that behaves like i_2 with respect to the question proposition, as shown in (21c).

- (21) a. $\llbracket (11a) \rrbracket^{i_0} = \{i_0, i_1\}$
 b. $\llbracket (11a) \rrbracket^{i_1} = \{i_0, i_1\}$
 c. $\llbracket (11a) \rrbracket^{i_2} = \{i_2\}$

As in Karttunen (1977), the question meaning depends on the evaluation index in Partition Semantics. But unlike in Karttunen's analysis, which makes no direct reference to false propositions, the question meaning effectively comes out as a set of mutually exclusive exhaustive propositions, thereby inducing a complete partitioning of the logical answer space in terms of possible worlds;

cf. also Hamblin (1958). This shifted perspective on the meaning of questions is not so evident in the case of polar interrogatives, which, by their very nature, induce a bipartition of the answer space, corresponding to the two possible answers *yes* or *no*. Knowing the complete set of possible worlds that make the question proposition true entails knowing which worlds do not. The difference is clearly visible in the case of *wh*-interrogatives, however: Consider again example (12a) in the above scenario with three singers. The formal meaning of (12a) in the Partition Semantics of Groenendijk & Stokhof (1984) is shown in (22): This semantic representation picks out all the indices j where the denotation of the questioned predicate is co-extensive to the denotation of the question predicate in the evaluation world w_0 . In this way, the question partitions the space of possible worlds into different cells, the members of which differ regarding how many and which individuals have the property of being listened to by Baptiste, and, crucially, which ones do not!

$$(22) \llbracket (12a) \rrbracket^{w_0} = \lambda j. [\lambda x. \text{listen}(\text{Baptiste}, x, w_0) = \lambda x. \text{listen}(\text{Baptiste}, x, j)]$$

If Baptiste listens to all three singers in w_0 , the denotation of (12a) will be the set containing all the worlds at which all three individuals, and no more, are contained in the set $\{x | \text{listen}(\text{Baptiste}, x)\}$. If he listens to Bowie and Johnny Cash in w_1 , (22) will yield the set of all the worlds in which Baptiste listens to these two singers, but not to FatBoySlim. If he only listens to Bowie in w_2 , the denotation of (12a) will correspondingly be the set containing the worlds at which Baptiste listens only to Bowie and nobody else. If Baptiste listens to nobody in w_3 , the meaning of the interrogative will be the set of worlds at which the set of singers Baptiste listens to is empty. The four evaluation scenarios with the corresponding sets of worlds/indices are illustrated in (23):

- (23) a. $\llbracket (12a) \rrbracket^{w_0} = \lambda i. \{\text{Bowie}, \text{Cash}, \text{FBS}\} = \{x | \text{listen}(\text{Baptiste}, x, i)$
 b. $\llbracket (12a) \rrbracket^{w_1} = \lambda i. \{\text{Bowie}, \text{Cash}\} = \{x | \text{listen}(\text{Baptiste}, x, i)$
 c. $\llbracket (12a) \rrbracket^{w_2} = \lambda i. \{\text{Bowie}\} = \{x | \text{listen}(\text{Baptiste}, x, i)$
 d. $\llbracket (12a) \rrbracket^{w_3} = \lambda i. \emptyset = \{x | \text{listen}(\text{Baptiste}, x, i)$

It is worth contemplating the difference between the Karttunen-semantics of *wh*-interrogatives and the Partition Semantics in a bit more detail. For Karttunen, each and every member of the extension of the term *Baptiste likes* in world w_0 forms a distinct true answer to the interrogative. Hence, each proposition of the respective form will be included into the set of true answers generated. For Groenendijk and Stokhof, in contrast, interrogatives denote only a single proposition, which is *about* the extension (in fact about the maximal

extension) of the predicate in question. Hence, each proposition in the set of Karttunen-alternatives that forms the extension of an interrogative will be entailed by the Groenendijk and Stokhof-style extension of that interrogative, but not vice versa. A truthful utterance of the answer *Baptiste listens to Bowie* does not exclude the simultaneous truth of the alternative proposition *Baptiste listens to Johnny Cash* and *Baptiste listens to FatBoySlim*, in case Baptiste happens to be a fan of all three singers.

For simplicity, we have so far always calculated the denotation of an interrogative at a given evaluation world, yielding in a sense the extension of that interrogative. It turns out that in contrast to declaratives, which have truth values as their extension, interrogatives have propositions as their extension. Of course, it is also possible to calculate the intension of interrogatives in the standard way, namely by creating a function from worlds or indices to extensions instead of evaluating at a certain index. Written this way, the underlying intensional meaning of interrogatives as equivalence classes over the space of indices becomes particularly transparent. At the same time, it emerges that – as opposed to the Hamblin-Karttunen version – Partition Semantics operates only on standard semantic objects (viz. propositions) and describes question semantics simply as an additional level of abstraction: the extensions of questions are like the intensions of answers. This fact can be seen as a specific conceptual advantage of Partition Semantics as compared to all other semantic approaches to questions in the sense that it sticks more closely to the original Montagovian program.

$$(24) \llbracket ?p \rrbracket = \lambda i. \lambda j. [p(i) = p(j)]$$

For the purposes at hand, the partition-based approach has in common with the alternative-based analyses in 2.2.1 that it also relies on an in-built notion of alternatives: Due to their semantic structure, overt questions open up an alternative answer space by partitioning the possible worlds into mutually exclusive sets, or cells, of worlds (Groenendijk & Stokhof (1984, p. 215)). The question is a request for information as to which of these cells the actual world is located in. The mutually exclusive cells correspond to equally mutually exclusive propositions, as originally envisaged by Hamblin (1958), which qualify as possible answers depending on which states-of-affairs obtain in the actual world. The discourse-semantic contribution of answers to questions, in turn, effectively consists in narrowing down the answer space opened up by the question. They do so by specifying the cell (or cells) that the actual world is located in relative to the requested information (Groenendijk & Stokhof, 1984, p. 337).

2.2.3 Structured Meanings

The Structured Meanings approach to question semantics goes back to Hull (1975), Hausser & Zaefferer (1979), Cresswell & von Stechow (1982), von Stechow & Zimmermann (1984), i.a., and was more recently defended in Krifka (2001). This approach differs radically from the alternative-based theories of questions and from Partition Semantics. Next to the reasons given in Krifka (2001), there are two major arguments that we wish to discuss here. The first one concerns the (lack of) expressive strength of alternative-based approaches, whereas the second one is related to more surface-oriented considerations regarding the nature of overt question-answer paradigms.

In the alternative-based approaches discussed in section 2.2.1, the meaning of a polar interrogative involves two propositions: the overtly expressed proposition and its negation. Hence, the question (11a) is represented as in (11b), with minor differences in Partition Semantics that we put aside here. Crucially, (11a) licenses a simple *yes* or *no* answer. Contrasting with this, the question (25) appears to involve the very same two alternative propositions, at least at some intuitive level, but still, it does not license *yes* or *no* answers. Krifka (2001, p. 14) in fact suggests that the only way (25)⁸ can be represented in alternative based approaches is in fact (11b). But if so, the observed difference in the ability to license *yes* or *no* answers is not accounted for. It seems, then, that the alternative approach is too coarse-grained to capture important linguistic generalizations about questions and answers.

(25) *Does Baptiste have a favorite Bowie song or doesn't he?*

- a. # *Yes.*
- b. # *No.*
- c. *He does(n't).*

The second problem is that the most natural answer to both polar and to wh-questions does not seem to involve full overt propositions. Instead, polar questions are readily answered by *yes* and *no* which appear to be particles at first sight rather than declaratives, and wh-questions most naturally receive term answers.

(26) a. *Does Baptiste have a favorite Bowie song?*

- b. *Yes.*
- c. *He has a favorite Bowie song.*

8 Questions in which the alternatives are introduced by disjunction rather than a wh-word are

- (27) a. *Who does Baptiste listen to?*
 b. *Bowie.*
 c. *Baptiste listens to Bowie.*

In alternative-based approaches, one would have to assume that the answers in (26b) and (27b) are elided versions of the full sentential answers in (26c) and (27c) respectively, as argued, e.g., in Merchant (2004). But it is also possible to conceive of a simpler theory of such term answers, on which the term answers in (26b) and (27b) are indeed all there is, and no ellipsis is required; cf., e.g., Jacobson (2011), Sag & Nykiel (2011), and others.

In Structured Meaning approaches, questions are formally represented as a tuple consisting of a background term and a restrictor set. The background term is a lambda abstract over a vector of variables of some type (in simple cases just one variable), and the restrictor set is a set of alternatives that can be applied to the background term as arguments. The representations of our example questions are given below. It is easy to see that the background term can directly combine with the term answer in both (28a) and (28b) and that the polar question and the alternative question receive different interpretations in (28a) and (28c).

- (28) a. $\llbracket \text{Does Baptiste have a favorite Bowie song?} \rrbracket =$
 $\langle \lambda f f (\lambda w. \exists x. \text{fav_Bowie_song}(x, \text{Baptiste}, w)), \{\lambda p. p, \lambda p. \neg p\} \rangle$
 b. $\llbracket \text{Who does Baptiste listen to?} \rrbracket =$
 $\langle \lambda x. \lambda w. \text{listen}(\text{Baptiste}, x, w), \{\text{Bowie}, \text{Cash}, \text{FatBoySlim}\} \rangle$
 c. $\llbracket \text{Does Baptiste have a favorite Bowie song or doesn't he?} \rrbracket =$
 $\langle \lambda f f, \{\lambda w. \exists x. \text{fav_Bowie_song}(x, \text{Baptiste}, w),$
 $\lambda w. \neg \exists x. \text{fav_Bowie_song}(x, \text{Baptiste}, w)\} \rangle$

Notice, too, that the representation of polar questions in Structured Meanings theories differs from alternative-based approaches in that it allows for a formal distinction between the positive and the negative version of the question: while the restrictor remains the same, the background term will differ depending on the polar alternative that is explicitly mentioned. The negative version of (28a) can be analyzed as in (29).

- (29) $\llbracket \text{Does Baptiste not have a favorite Bowie song?} \rrbracket =$
 $\langle \lambda f f (\lambda w. \neg \exists x. \text{fav_Bowie_song}(x, \text{Baptiste}, w)), \{\lambda p. p, \lambda p. \neg p\} \rangle$

also known as alternative or disjunctive questions. We will widely ignore alternative questions in this paper, see, e.g., Farkas & Roelofsen (2015) for some discussion.

At first sight, this seems to be a welcome result in the sense that the two questions would indeed seem to require different representations. At the same time, the assumption that plain *yes* and *no* answers to the two questions simply induce reverse interpretive effects seems to be too simplistic and empirically incorrect. The observable facts are more complex. In particular, negative questions do much more than just reversing polarity. Negative questions tend to be biased in various ways and tend to also hint at the information states of speaker and hearer with respect to existing evidence for the positive or negative answer cf. Romero & Han (2004), Farkas & Roelofsen (2015), Kramer & Rawlins (2011), Krifka (2013); see also AnderBois (2019). Hence, scholars agree that there is an asymmetry between positive and negative polar interrogatives in many languages. While most approaches that model such asymmetries need some modifications of alternative-based theories of questions, they do not move to a Structured Meanings type of analysis. The same applies *mutatis mutandis* to disjunctive interrogatives, which can have fairly subtle meaning differences depending on intonation.

In sum, it is far from clear whether the adoption of a Structured Meaning analysis of questions is warranted on empirical grounds. At the same time, Structured Meanings and alternative-based approaches are quite similar in other respects and systematically related to one another: It is always possible to derive the formal representation in the alternative-based approach from the Structured Meaning representation with the help of the functional rule *A* (taken from Onea 2016) given in (30), but not vice versa. In other words, we lose information in changing over to the alternative representation, which makes the Structured Meaning approach the more powerful of the two.⁹

(30) **Convert Structured Questions into Alternative Questions:**

A: domain of structured questions → sets

$$A(S) = \{S_1(a) \mid a \in S_2\}$$

where *S* is some structured question denotation, and *S*₁ and *S*₂ are the first and second projection of the respective tuple.

Irrespective of individual differences in the formal modeling of overt questions (sets of propositions, partition cells, Structured Propositions), the three analyses discussed all have in common that they open up a space of propo-

9 This has long been acknowledged in the literature, cf. Rooth (1992), Krifka (2006a), Beaver & Clark (2008). The actual proof that the expressive power of Structured Meaning approach is higher is more complicated.

sitional alternatives or alternative action moves for the addressee to choose from. Any choice from within this alternative space constitutes a natural, unmarked answer to a question. A departure from this alternative space, by contrast, will require additional effort in discourse management, such as the use of special prosody or the insertion of discourse particles (Beaver & Clark 2008, Zeevat 2003); see the discussion of discourse particles in section 4.2.

2.3 *Semantic Properties of Interrogatives: Existence, Exhaustivity, D-linking*

While the core semantic contribution of all kinds of interrogatives consists in presenting the addressee with an alternative space to choose from, and thereby to add to the information stored in the Common Ground, there are additional semantic effects that are often considered as belonging to the meaning of wh-interrogatives proper. Sub-section 2.3.1 discusses existence presuppositions and related effects; sub-section 2.3.2 looks at exhaustiveness effects. Finally, sub-section 2.3.3 concludes with a few comments on difficulties arising in connection with *which*-questions.

2.3.1 Existence Presupposition in Wh-interrogatives?

If we consider again the interrogative *Who does Baptiste listen to?* in (12a), it seems that a precondition for the felicitous utterance of that question is that addressee and speaker agree on there being some singer that Baptiste listens to. In the normal course of events, somebody asking (12a) would seem to presuppose that there be some such singer, and then to inquire about who this person is. The question then arises as to whether this additional interpretive effect should also be registered in the meaning of wh-interrogatives, for instance in the form of an existence presupposition?

In all three frameworks considered so far, it is easily possible but not necessary to add an existence presupposition to the meaning of wh-interrogatives. This can be done, for instance, by adding a formal requirement that the answer space of the question does not include a proposition (or a possibility) making the backgrounded predicate *Baptiste listens to* come out empty, and by further postulating a semantic rule ensuring that the answer space of the question contains a true answer. Still, the assumption of existential presuppositions with wh-questions has not gone unchallenged in the literature. In this section, we will present arguments for and against the assumption that wh-interrogatives come with an existential presupposition. We will tentatively suggest that the weaker notion of an *existential supposition* might be sufficient for accounting for the observable facts. In what follows, when using the term *existential presupposition*, we, therefore, do not commit to the exis-

tence inference being a presupposition in a technical sense. Rather, we use the traditional term in a theoretically neutral way for referring to this inference.

We start with arguments against the assumption that the existential inference is indeed a presupposition. A main argument is that the question in (31a) can be naturally answered with (31b). In fact, it is much more natural to respond to the question with (31b) than with (31c), which is a natural way of challenging bona fide presuppositions (von Stechow, 2004). Another argument that Onea (2016) attributes to Jeroen Groenendijk is that there is no compelling evidence from presupposition projection that would show that *wh*-questions do indeed have an existence presupposition.

- (31) a. *Who does Baptiste listen to?*
 b. *Nobody/ Baptiste listens to nobody. (Baptiste doesn't like popular music)*
 c. *? Hey, wait a minute, Baptiste doesn't like popular music.*

Also notice that the response in (31b) does not have the deviant status of a typical presupposition violation, such as is found, for instance, with the additive existence presupposition triggered by the additive particle *also* in (32):

- (32) *I listen to only one singer. #And I also listen to Johnny Cash.*

A final argument against positing existential presuppositions in *wh*-interrogatives is that the acceptable question-answer pair in (31a) and (31b) differs in acceptability from its minimal counterpart in (33) with a so-called clefted question. The latter is arguably unacceptable:

- (33) a. *Who is it that Baptiste listens to?*
 b. *#Nobody/ Baptiste listens to nobody. (Baptiste doesn't like popular music)*

The difference follows on the standard analysis of cleft sentences (Horn 1981, Rooth 1996, Percus 1997, Zimmermann & Onea 2011), on which such structures do indeed trigger an existence presupposition. Crucially, if the existence presupposition of clefts accounts for the unacceptability of (33b), it is difficult to argue that the very same existential presupposition is present in (31) as well.

In response to this problem, scholars like Karttunen (1977), Hintikka (1978) and most recently Haida (2007) have argued that a negative response to a *wh*-interrogative is not a direct answer, but rather a rejection of the question as an unsuitable speech act in the current discourse state. Notice, however, that this

argument does not seem to extend to examples like (33): If *nobody*-responses reject ordinary *wh*-questions, then why do they fail to do so if the question is clefted?

A seemingly strong argument for assuming that the existential inference is indeed a presupposition is constituted by the fact that plain existential statements cannot be used for answering *wh*-questions, as shown in (34), cf. Haida (2007). If the question had no existential presupposition, (34b) should be an informative statement:

- (34) a. A: *Who does Baptiste listen to?*
 b. B: ?? *Baptiste listens to someone.*

If we assume that *wh*-questions do not have an existential presupposition, the main challenge is to explain why the answer (34b) is not acceptable. Here, the situation does not seem entirely hopeless. For instance, one could assume that there was a more direct way to ask whether Baptiste listens to anybody, e.g., by uttering (35). Since the speaker asked (34a), this may give rise to an implicature that the speaker assumes the answer to (35) to be already known. If so, it is much more likely that the speaker assumes that the answer to (35) is *yes* than *no*, as otherwise the question (34a) would not make any sense: the speaker would already know the answer (namely: *Nobody*).

- (35) *Does Baptiste listen to anyone?*

Finally, we still need to answer the question of how to account for the frequently observed existence inferences even with plain *wh*-interrogatives. There are in principle two options. The first is to treat overt *wh*-interrogatives as simplified surface occurrences of structurally more complex underlying sequences of questions. This is informally shown in (36):

- (36) *Who does Baptiste listen to?*
 a. *Does Baptiste listen to anybody?*
 b. *If so, who does Baptiste listen to?*

On this account, negative answers would simply address the first question in the underlying question sequence.¹⁰ Alternatively, one could maintain the general presence of an existence inference in unmarked complement questions by

¹⁰ Cf. Geurts & van der Sandt (2004) for an analysis of negative responses to constituent

weakening the nature of the interpretive effect from presupposition to that of a mere *supposition*. This is the approach advocated in Büring (2004) for the analysis of existence effects with focus in declarative utterances. Focus constituents are commonly analyzed as the formal counterparts of *wh*-expressions, supplying the information requested by the *wh*-expression in the interrogative (cf. Roberts 1996, Kratzer & Selkirk 2007, Krifka 2008, Beaver & Clark 2008). The weaker interpretive flavor of suppositions stems from the fact that, unlike with presuppositions, the felicity of suppositions is not tied to concrete state-of-affairs in the world of evaluation, but rather to speaker expectations concerning such state-of-affairs and possible future developments of the discourse; cf., e.g., Grubic (2015) for extensive discussion. In other words, when uttering a *wh*-interrogative, a speaker normally indicates that s/he assumes or expects there to be some individual(s) with the relevant property in question, and that s/he expects an affirmative response specifying these individual(s). The supposition could be coded either as part of the use-conditional meaning of *wh*-interrogatives in the sense of Gutzmann (2012), for instance in the *wh*-operator; or else, under the common assumption that *wh*-words are focused as in Haida (2007) and many others, it could be attributed to the general workings of focus, for instance in the framework of privileged possible worlds developed in Zimmermann & Onea (2011).¹¹ Since the existence effect in plain questions is no longer coded as part of the truth-functional component of questions, it follows that negative answers to questions come out as licit and natural. Such answers merely indicate that the actual world is not among the privileged possible worlds identified by the interlocutor as the most likely candidate worlds for the actual world. Interestingly, the existence suppositions of plain *wh*-interrogatives can be bound, on a par with bona fide presuppositions (van der Sandt, 1992). The discourse sequences in (37) and (38) illustrate:

- (37) a. *I doubt that anybody won.*
 #*Who won?*

questions in terms of polar yes/no-focus, which could be cashed out in terms of answers to polar yes/no-interrogatives

- 11 Onea (2016) proposes a third version of this idea. He suggests that the positive alternatives play a distinguished role in the semantic representation of questions, thereby determining the felicity conditions of questions. While negative alternatives do count as direct or congruent answers to *wh*-questions, the pragmatic use conditions of questions seem to be violated whenever a negative answer holds true. As Onea's analysis uses a more complex system representing questions within the broader framework of Inquisitive Semantics, we will return to this later in section 3.

- b. *I doubt that anybody won.*
But if anybody won, who won?

- (38) a. Q: *If anybody won, who won?*
 A: *#Nobody won.*
 b. Q: *Did anybody win? And if so, who won?*
 A: *Nobody won.*

In (37a), the existence supposition of the wh-interrogative is put in doubt by the preceding sentence, resulting in infelicity resulting from the speaker-internal inconsistency. By contrast, the supposition in (37b) is bound by the existential in the conditional antecedent, rendering the sequence consistent in the local context and, hence, felicitous in spite of inconsistency with the global context. Similar facts are observed in (38), where the infelicitous answer must be interpreted relative to the local conditional context in (38a) in the absence of a global context. In (38b), by contrast, the existence supposition of the wh-interrogative is again bound by the conditional antecedent, thereby ensuring consistency of the answer with the global context.

2.3.2 Exhaustiveness

The formal analyses differ in part when it comes to a second prominent interpretive effect that is often discussed in connection with overt questions, namely their (non-) exhaustiveness. As discussed above, a central motivation for introducing Partition Semantics was that under certain embedding predicates, such as *to know*, the wh-interrogative seems to do more than just denoting the set of true answer propositions for the matrix sentence to come out as true. In such cases, interrogatives appear to express an explicit statement about the maximal extension of the question predicate. Groenendijk and Stokhof argue that this exhaustiveness effect follows from an inherently exhaustive semantic interpretation of the embedded interrogative. Groenendijk & Stokhof (1982, p. 180) distinguish three degrees of exhaustivity and argue that exhaustivity at the lowest degree (later known under the label of weak exhaustivity, following Bäuerle & Zimmermann 1991) would ensure that if (39) is true, then Peter will know of every individual who left that this individual left (and not just of some individuals). The second degree of exhaustivity, also called intermediate exhaustivity, would require for Peter to know of every single individual who left that this individual left, and in addition, to lack false beliefs of the type that *x* left for any individual *x* who did not leave. Finally, strong exhaustivity suggests that Peter knows of all individuals who left that they left and of all individuals who did not leave that they did not leave.

(39) *Peter knows who left.*

Partition Semantics very naturally lends itself to account for (39), which arguably only has the strong exhaustive interpretation. This observation is complemented by findings in the seminal paper by Heim (1994), in which it is argued that the denotation of embedded interrogatives is only one factor in the semantic interpretation of the entire clause. Another factor could be the lexical semantics of the embedding verb, as will be shown below. Since then, the question of whether Partition Semantics is absolutely necessary on grounds of the exhaustive interpretation of embedded interrogatives has come under intense scrutiny in the literature. In summing up this discussion, we will refer to Karttunen or Hamblin-style questions as non-exhaustive questions, whereas we will refer to Groenendijk and Stokhof-style questions as exhaustive questions.

As indicated above, the strongest empirical argument in favor of building an exhaustive meaning component into questions comes from the study of embedded interrogatives, such as (17) to (19), in which the interrogative occurs embedded under the particular matrix predicate *know*. This was shown for (19), repeated as (38), which entails that Peter knows that Marvin left if Marvin left and that Peter knows that Otto didn't leave if Otto didn't leave, and which – moreover – is equivalent to its negated counterpart because of exhaustiveness:

(40) *Peter knows who left.* ↔ *Peter knows who didn't leave.*

Extrapolating from the exhaustiveness of *wh*-interrogatives embedded under the predicate *to know*, Groenendijk & Stokhof (1984) assume that exhaustiveness is a defining property of matrix interrogatives as well, and, hence, of all kinds of overt questions. The exhaustiveness follows directly on the Groenendijk & Stokhof (1984) partition-based approach. The general exhaustiveness of questions, embedded or not, has been questioned, however, by Heim (1994), who, following Bäuerle & Zimmermann (1991) and Berman (1991), observes that *wh*-interrogatives embedded under matrix verbs other than *to know* often do not come with a strong exhaustive interpretation, and, therefore, do not behave as predicted by Groenendijk & Stokhof (1984).

Consider, for instance (41), where the matrix predicate *wonder* embeds a so called *mention-some question*, which is preferably interpreted as non-exhaustive (Bäuerle & Zimmermann, 1991, p. 343). In fact, mention-some questions do not even require weak-exhaustivity: a single true proposition will often do as a satisfactory answer.

(41) *Max is wondering where he can buy a Finnish newspaper.*

Sentence (41) does not express Max's desire for information concerning all the places where Finnish newspapers are sold. Some such places, or even one, would do. This finding is matched by an observation in Karttunen (1977, p. 22) that (42a) and (42b) are intuitively not equivalent, as they should be if the embedded *wh*-interrogatives were truly exhaustive; cf. Heim (1994, p. 137), and also Groenendijk & Stokhof (1984, p. 158, fn. 6) for a conflicting view.

- (42) a. *Bill is wondering who dates Mary.*
 b. *Bill is wondering who does not date Mary.*

Non-exhaustive interpretations also show up with other kinds of embedding verbs, such as the speech act verbs *to tell*, *to remind*, and *to write down* (Karttunen 1977, p. 11, Heim 1994, p. 137) and the verb *surprise* (Berman 1991, Heim 1994, p. 139). In order for (43a) to be true, the list of people named by John must comprise all the individuals that actually passed. However, (43a) does not become incorrect if John mistakenly includes in his list some individuals that did not pass, as shown by the felicity of the discourse sequences in (43b). Nor does (43a) seem equivalent to its negated counterpart in (43c) on a speech act verb interpretation of *tell*:

- (43) a. *John told Mary who passed the test.*
 b. *John told Mary (correctly) who passed the test, ...*
 (i) *but he mistakenly included a few students that did not.*
 (ii) *indeed, in his eagerness, he even named a few students that did not.*
 c. *John told Mary who did not pass the test.*

The data in (42) and (43) show that (embedded) questions are not always exhaustive. In particular, the truth of (43a) does not depend on who did not pass the test and whether or not John included these people in his list. Berman (1991) makes a similar point regarding the embedding verb *surprise* in (44):

(44) *It surprised Peter who showed up for the party.*

Again, the truth of (44) only depends on John's expectations concerning the people that actually showed up: he did not expect some of them. Conversely, (44) does not become true if some of the expected people did not show up, as

would be predicted if *wh*-questions were inherently exhaustive. This assumption has, however, been recently challenged by experimental evidence provided in Cremers & Chemla (2017) – it remains to be seen how experimental findings will eventually influence this debate.

Summing up so far, *wh*-interrogatives embedded under matrix predicates other than *know* need not (necessarily) receive a strong exhaustive interpretation, for which reason a weaker interpretation of questions is called for. This is unexpected on the partition-based analysis of questions, which treats them as invariably exhaustive, as shown by Heim (1994, p. 136). In response to this finding, Heim (1994) opts for a modified Karttunen-analysis that analyses question in terms of alternative (true) propositions. Following a suggestion in Karttunen (1977), Heim (1994, p. 133) accounts for the exhaustive interpretation of interrogatives embedded under *know* by attributing the effect to the lexical meaning of *know*, which denotes an attitude of an individual x to some question intension q relative to an evaluation world w_0 . According to the lexical entry in (45), an individual x knows the answer to a question intension q in w_0 if and only if x believes the proposition that is true in all worlds w' if the extensional meaning of the question intension q applied to w' is equivalent to the meaning of the question intension applied to the evaluation world w_0 , i.e., in all worlds w' in which the questioned predicate is satisfied by the very same individuals as in w_0 :

$$(45) \llbracket \textit{know} \rrbracket(w_0)(q)(x) = \textit{believe}(x, \lambda w' [q(w') = q(w_0)], w_0)$$

The exhaustification procedure used by Heim is very similar to the exhaustification method used by Groenendijk & Stokhof (1984). Crucially, though, in Heim's account, the exhaustiveness of questions embedded under *to know* and related verbs enters the semantic derivation as part of the lexical meaning of such verbs rather than as a built-in property of questions. This accounts for the absence of exhaustiveness effects observed with other classes of embedding verbs in (41) to (44), and it also explains why the most convincing examples for exhaustiveness in questions invariably feature the matrix verb *to know*.

Subsequent work has sometimes suggested that both weak and strong exhaustivity will have to be captured in the formal semantic analysis of questions, and there are various proposals as to how to achieve this greater flexibility in question semantics. Rullmann (1995), for instance, suggests that the strong exhaustivity reading of Groenendijk & Stokhof (1982) is brought about by a covert maximality operator. This maximality operator, initially defined by Link (1983) and shown in (46b), can be applied to plural definite NPs. Under the assumption that the denotation of plural nouns is closed under sum individual

formation, the denotation of *the boys* in (46a) will single out the sum individual that includes all individual boys.

- (46) a. $\llbracket \text{the boys} \rrbracket = \text{MAX}(\llbracket \text{boys} \rrbracket)$
 b. $\text{MAX}(A) = \iota x.[x \in A \wedge \forall y \in A \rightarrow y \leq x]$
 where $\leq$ is mereologic inclusion.

Rullmann suggests that the same maximality operator is not limited to individuals but can also apply to more abstract entities like numbers, degrees, etc. This operator can be then added to a Karttunen style question denotation, hence, yielding a strong reading similar to the strong exhaustivity discussed by Groenendijk and Stokhof, as shown in (47). The resulting reading of (47a) can be paraphrased as in (47b).

- (47) a. $\llbracket \text{What did Baptiste read?} (w) \rrbracket =$
 $= \lambda p. \exists x. p(w) \wedge p = \lambda v. x = \text{MAX}(\lambda y. \text{read}(\text{Baptiste}, y, v))$
 b. What is the maximal sum individual that contains all things that Baptiste read?

Similarly, then, (48a) is a question about the maximal number of Bowie songs known to Baptiste rather than just any number of Bowie songs known to Baptiste, as paraphrased in (48b). Here, the notion of maximality is defined in terms of informativity, as shown in (48c).

- (48) a. *How many Bowie songs does Baptiste know by heart?*
 b. *What is the maximum number of Bowie songs that Baptiste knows by heart?*
 c. $\lambda p. \exists n. p(w) \wedge p = \lambda v. n = \text{MAX}(\lambda n'. \exists x. \text{song}(x, v, n') \wedge \text{knows}(\text{Baptiste}, x, v))$

The MAX(imity)-operator account is extended by Beck & Rullman (1999) into a more general account of exhaustive interpretations as complete, i.e., maximal true answers to questions. The point to notice here is that according to Beck and Rullmann (and arguably large parts of the literature ever since) it is unnecessary to incorporate the notion of maximal answers into the definition of what a question is. Instead, if a question is defined solely on the basis of its answerhood conditions, maximality can be optionally induced as an interface condition when integrating a question into its linguistic or pragmatic environment. Common devices to achieve just that are covert MAX or EXH operators; see below.

Taking up another observation by Heim (1994, p. 137), Spector (2006) and Klinedinst & Rothschild (2011) point out the existence of a third interpretation for embedded interrogatives:¹² this so-called intermediate interpretation (postulated but not clearly empirically acknowledged by Groenendijk & Stokhof 1984) is stronger than the weakly exhaustive Karttunen-interpretation, but weaker than the strongly exhaustive interpretation of Groenendijk & Stokhof (1984). While Spector discusses such readings with factives, Klinedinst & Rothschild (2011, p. 7) suggest that they also show up with non-factive verbs of saying such as *tell* and *predict*. An example is given in (49):

- (49) A phone survey is taken to assess audience interest in last night's episode of a televised talent show, by checking their recall of the contestants. Arthur says, "*I'm sure Frank sang and Emilio sang, and I'm not sure about anyone else.*" Bert says, "*Frank, Emilio, Bill and Ted sang.*" It is decided to send a thank-you prize to Arthur but not Bert on the grounds that it's true that Arthur told us who sang, but Bert didn't.

According to Klinedinst & Rothschild (2011), the only consistent interpretation for the final sentence is the one on which the VP is interpreted as *x told us of everybody who sang that he sang and he didn't say of anybody else that this person sang*. Deviating from Spector (2006), Klinedinst & Rothschild (2011) do not derive the three-way ambiguity from a lexical ambiguity of the embedding verb, but rather from a covert non-local exhaustivity (EXH-) operator¹³ that derives the intermediate and strongly exhaustive interpretation from a basic non-exhaustive Karttunen-meaning of interrogatives in compositional fashion: Without the EXH-operator, the Karttunen-meaning is preserved, cf. (43b). If the EXH-operator applies below the embedding verb, the result will be a strongly exhaustive reading. If the EXH-operator applies above an embedding non-factive verb, the result will be an intermediate interpretation. Finally, the EXH-operator applies vacuously when occurring above factive embedding verbs such as *know*. This line of reasoning is taken up in Uegaki (2015), who proposes an even more uniform structural analysis: The different semantic interpretations follow from an (optionally inserted) EXH-operator in the matrix clause that systematically interacts with the lexical monotonicity properties

12 Recent experimental studies provide evidence favoring these empirical claims, cf. Cremers & Chemla (2016).

13 Cf. Chierchia (2013) for ample discussion of the role of this operator in grammar, including the derivation of various implicatures and polarity effects.

of the embedding attitude verbs. Once again, this approach assumes a basic non-exhaustive interpretation for embedded interrogatives, and exhaustification is conceived of as a way of integrating them into their linguistic environment.

A final empirical argument against the in-built exhaustiveness of questions is put forward in Zimmermann (2007), who investigates the exhaustifying question particle *w-alles* ('wh-all') in German. This particle is also discussed in Reis (1992), Beck (1996), Reich (1997), and Beck & Rullman (1999), and its counterpart *all* in varieties of English in McCloskey (2000). In Ulster English, for instance, wh-interrogatives can be modified by the question particle *all*, resulting in a stronger, exhaustified interpretation: The exhaustified question in (50a), for instance, asks for a complete list of things desired by the salient third person individual. (50b) shows the same effect for *w-alles* interrogatives in German.

(50) a. *What (all) did he say (all) that he wanted (all)?* (McCloskey (2000, p. 61))

b. Q: *Wer hat alles bei SALT25 vorgetragen?*

who has all at SALT25 presented

'Who-all presented at SALT 25?'

A: *#Zwei Tübinger Studentinnen und Daniel Buring.*

two Tübingen students-FEM and DB

'Two Tübingen students and Daniel Buring.'

Crucially, in (50b) the answer is infelicitous only because of the exhaustiveness requirement induced by *alles*, which requires (ideally) a complete list of presenters at SALT25 (perhaps a significant subset including invited speakers will suffice as well). By contrast, the very same answer would make a perfectly licit answer to the plain counterpart of the question in the absence of the exhaustifying particle. Moreover, Zimmermann (2007) shows, based on minimal pairs such as in (51), that the syntactic construal of the question particle in multiple questions has an effect on the overall interpretation of such questions. In particular, in (51a), the particle *alles* ranges over the subject wh-element whereas in (51b), it ranges over the object wh-element, thereby triggering a different, object-exhaustified interpretation.

(51) a. *Wer_i hat t_i alles für wen gestimmt.*

who has all for whom voted.

'Who all voted for whom.'

→ exhaustive list of voters

- b. *Wer hat für wen alles gestimmt*
 who has for whom all voted.
 'Who voted for whom all.' → exhaustive list of votees

Based on the observable differences in interpretation, Zimmermann (2007, 2012) concludes that the question particle *alles* forms part of the compositional truth-functional core meaning of interrogatives, instead of contributing to their use-conditional meaning. This is evidenced by the fact that the semantic contribution of *alles* in embedded interrogatives is visible to a negation operator in the matrix clause. Because of this, (52) with focus on *alles* is grammatical and acceptable as the higher negation targets the exhaustiveness of the embedded question. The unacceptable variant without *alles*, by contrast, expresses a contradiction between the two coordinated clauses:

- (52) *Maria weiß nicht, wen Klaus #(ALLES) eingeladen hat, aber sie*
 Mary knows not whom Klaus all invited has but she
weiß (zumindest), dass er seine Eltern eingeladen hat.
 knows at least that he his parents invited has
 'Mary doesn't know ALL the people that Klaus invited, but she knows (at least) that he invited his parents.'

It is not obvious how to model the exhaustifying effect of such universal question particles in a partition-based analysis of questions, since questions are inherently exhaustive in such analyses to begin with.

In sum, then, the existence of exhaustifying particles in interrogatives, when taken together with the variable interpretation of embedded interrogatives, poses a severe challenge for the assumption that questions are inherently exhaustive. Put differently, the weakest conclusion following from this discussion is that non-exhaustive, weakly exhaustive and intermediately exhaustive readings of questions seem to exist alongside strongly exhaustive readings, with their availability conditioned by the context and the linguistic environment. On the common assumption that the Partition Semantics approach is inherently incompatible with weaker exhaustive or non-exhaustive readings of interrogatives, one would be compelled to conclude that partition-semantics must be given up as a model for interrogative meanings, despite its overall conceptual merits.¹⁴ We will return to this important issue in our discussion

14 Beaver & Onea (2015) show that it is possible to construct the set of Hamblin-alternatives from a partition in dynamic semantic settings. In light of this, abandoning Partition Se-

of inquisitive semantics in section 3, which incorporates some insights from partition-semantics without being committed to the strong view that all question meanings are strongly exhaustive.

2.3.3 The Interpretation of Which-Questions

Interrogatives involving *which NP* as a question phrase rather than *who* or *what* appear to be more complex and more interesting for a variety of reasons. At first sight, one might conjecture that the only difference between these types of questions is that a question word like *who* has an implicit restrictor which is explicit in *which*-questions. In a sense, some of the problems arising in connection with *which*-questions are implicitly present in *who* and *what* questions as well. It just so happens that scholars tend to abstract away from the arising complications with *who*- and *what*-questions. Indeed, it is difficult to see a difference between these types of questions and *which*-questions with an extremely general NP-restriction, as in *which person* or *which thing*. At the same time, the two question types exhibit visible empirical differences. Consider, for instance, a classical observation from the syntactic literature on superiority effects:

The superiority condition as formulated in Pesetsky (1987, p. 104) states that in “a multiple interrogation, where a *wh*-phrase is in *Comp* and another is in *situ*, the *S*-structure trace of the phrase in *Comp* must c-command the *S*-structure position of the *wh*-in-*situ*.” This correctly predicts the contrast between (53a) and (53b), (53b) being unacceptable because the *what*-trace does not c-command the in situ *whom*.

- (53) a. *Whom_i did you persuade t_i to read what?*
 b. *??What_i did you persuade whom to read t_i?*

Crucially, the contrast systematically disappears with discourse-linked *wh*-phrases (in the sense of Katz & Postal (1964)) i.e., *which NP* phrases.¹⁵ This is witnessed in (54):

mantics is not a necessary consequence of theories advocating the necessity of Hamblin-alternatives as question meanings. This is because Hamblin-alternatives are always derivable with the help of some intermediate operator.

15 For the notion of discourse-linked or d-linked *wh*-words see also Enç (1991) and Pesetsky (1987). It is oftentimes assumed that at least part of *which NP* phrases is linked to a previously established set of individuals.

- (54) a. *Which man_i did you persuade t_i to read which book?*
 b. *Which book_i did you persuade which man to read t_i?*

This empirical contrast led Pesetsky (1987) to believe that *which*-NPs receive scope by a co-indexing mechanism going back to Baker (1970), in which scope is determined by co-indexing *wh*-expressions with question operators, and which is quite similar to mechanisms postulated for the interpretation of indefinites in Heim (1982). Ordinary *wh*-expressions, by contrast, receive scope by movement, as suggested in Huang (1982) and subsequent work. We will not consider the details of the syntactic mechanisms of scope taking for *wh*-expressions in this paper, partly because the recent literature has cast doubt on some of Pesetsky's basic generalizations; cf. eg. Alexopoulou & Keller (2013). We do take note of the fact, however, that the semantic property of *which*-interrogatives that is most likely responsible for some of their crucial properties is tightly linked to their peculiar discourse-linked interpretation: Such d-linked *which*-NPs are not just interpreted as general *wh*-questions involving a more restricted domain of alternatives as compared to *what*- or *who*-interrogatives. Instead, with *which*-NPs the common ground typically provides a set of discourse referents with the NP property, and it is only among these discourse-given referents that the relevant alternatives are generated. In principle, it seems possible to account for the d-linking property of *which*-questions by treating them as grammaticalizations of the discourse strategy of *question restriction*, to be discussed in section 4.4. Also notice that the fact that *which*-questions point to the existence of referent sets with the NP property in the context would account for their ready occurrence in multiple *which*-questions, such as (54) in contrastive topic contexts, to be discussed in section 4.1.2. If so, it seems possible, at least in principle, that superiority effects can be derived from general constraints on discourse structure. For now, we will set aside the issue of *which*-questions and discourse structure for future research.

Instead, we will focus on a more general problem with the interpretation of *which*-interrogatives, namely their ambiguity between a *de-re* and a *de-dicto* reading, cf. Belnap (1963), Karttunen (1977), Groenendijk & Stokhof (1984), Beck & Rullman (1999) and others. Consider the example in (55).

- (55) *Which professor danced?*

As compared to the question *Who danced?* the main difference seems to be that (55) is only about professors, hence, intuitively, we would want to narrow down the alternatives. There are two basic approaches to the problem. The first option is to only generate alternative individuals that are professors as a deno-

tation for *which professor*. This would amount to *domain narrowing* or *domain restriction* in comparison to the corresponding unconstrained *who*-question. Alternatively, one can include the information into each alternative that the relevant individual in question is a professor. This procedure makes sure that those alternatives that are not professors are excluded automatically by *informative extension* cf. Onea (2016). The two possible strategies are illustrated for (55) in (56) in a Hamblin-style notation.

- (56) a. $\{\{w|\text{danced}(x, w)|\text{professor}(x, w_0)\}$ de re
 where w_0 is the world of evaluation.
 b. $\{\{w|\text{danced}(x, w) \wedge \text{professor}(x, w)\}|x \in D_e\}$ de dicto

To see the difference between the two interpretations, consider the following inference pattern in (57):

- (57) $\frac{\text{Peter knows who danced.}}{\text{Peter knows which professor danced.}}?$

If we assume that for Peter to know who danced means that he has an answer to the question whether x danced for any individual x , then whether the argument in (57) is valid or not depends on how we interpret the embedded question *which professor danced*. If we assume a de dicto interpretation, the argument does not go through, since it may be the case that Peter knows that Mel danced but he does not know whether Mel is a professor or not. However, if we assume a de re interpretation, the argument will come out as valid as Peter only has to know for each individual that independently qualifies as a professor whether that individual danced or not. And that, of course, he is bound to know, since the individuals who qualify as professors are a subset of the set of individuals who qualify as humans. In compositional terms, the two readings can be derived, for instance, as in (58):¹⁶

- (58) a. $\llbracket \text{which}_{de_dicto} \rrbracket = \lambda P.\lambda Q.\{p|\exists x.p = \lambda w.Q(x, w) \wedge P(x, w)\}$
 b. $\llbracket \text{which}_{de_re} \rrbracket = \lambda P.\lambda Q.\{\lambda w.Q(x, w)|P(x, w_0)\}$

16 The lexical entries gloss over some important issues. To name but one, an interrogative may contain several *which*-NPs. For this reason, the semantic work attributed to *which* in (58) has to be distributed over the determiner *which* and a sentential question operator, cf., e.g., Kratzer & Shimoyama (2002), Beck & Rullman (1999), Onea (2016) and many others for more elaborate lexical entries.

The de-re reading of *which*-questions can be seen as a natural way to capture the discourse linking nature of which-NPs as suggested in Katz & Postal (1964) or Pesetsky (1987). However, while working fine for embedded questions, it is not altogether clear whether the de re reading is suitable for matrix questions as well. The problem is that alternatives could be generated by using the set of individuals in the restrictor of the *which*-NP in the evaluation world w_0 , and then alternative propositions could be generated that are no longer restricted to worlds in which the respective individuals still qualify as having the restrictor property. This is because the evaluation of the nuclear scope Q in (58b) is not tied to the evaluation world w_0 . As a result, the question in (55) would be fully compatible with an answer proposition that states that John danced, even if this proposition would contain worlds in which John is a butcher. However, in (59), the answer seems to entail that Rex is a professor rather than a butcher.

- (59) A: *Which professor danced?*
 B: *Rex.*

The de dicto reading offers, again, some advantages for the embedded case, as discussed, e.g., in Beck & Rullman (1999) in more detail. At the same time, it also gives rise to a well-known problem, namely the problem that the predicate **professor** and the predicate **danced** are treated symmetrically. Because of this, the question in (55) should be equivalent to *Which of the individuals who danced are professors?*, contrary to fact; cf. Krifka (2011) for some recent discussion. Still, it would seem that a de dicto style approach may be better suited for an account of matrix questions and for the phenomenon of discourse linking, as it captures the entailment of (59) that Rex is a professor. Discourse linking would then have to be formally implemented by an additional (pre)suppositional meaning component.¹⁷

This concludes our cursory discussion of the major formal semantic theories of interrogatives. We have reviewed three types of theories and evaluated them briefly by relating them to well-established interpretive properties of interrogatives, especially under embedding. Overall we observed that all three types of approaches have important conceptual strengths. Nevertheless, based – among others – on arguments from the exhaustivity debate, it seems that most of the literature in the past two decades has adhered to alternative-based approaches

17 The exact spell-out of such a presupposition is non-trivial. Certainly, the presupposition that when asking *Which professor danced?* the speaker must already know who the professors are, seems too strong. Weaker presuppositions (e.g., that the speaker does not know who danced) may, however, also be considered.

to question semantics. Yet more recently, the development of the broader research framework of *Inquisitive Semantics* has opened up a new perspective on these issues and has led to a rethinking of the foundations of Alternative Semantics within this framework. We turn to Inquisitive Semantics now.

3 Questions in Inquisitive Semantics

A basic requirement for any formal theory of questions is that it must distinguish between questions and assertions in a systematic fashion. In Structured Meanings, questions are functions to propositions and assertions are propositions themselves. In alternative-based approaches, e.g., Hamblin (1973) or Karttunen (1977), questions are analyzed as sets of propositions, whereas assertions are simply propositions. This type-theoretic difference appears to be at odds with the fact that questions and assertions can be coordinated, as discussed in Groenendijk & Stokhof (1984) and shown in (60a), and with the fact that declarative assertions may turn into questions by means of rising intonation alone, as in (60b), cf., e.g., Bartels (1999) or Gunlogson (2001).¹⁸ Recall that, because of these facts, Groenendijk & Stokhof (1984) downtyped the extensional meaning of interrogatives to propositional objects of type $\langle s, t \rangle$.

- (60) a. *Bernie knows that Donald talks trash and whether Hillary likes him.*
 b. *John was dancing/?*

As opposed to a purely type-theoretic formal distinction between declaratives and interrogatives, Inquisitive Semantics introduces a meaningful, content-driven and discourse-based distinction between questions and assertions by providing a unified theory of questions and assertions. The crucial step is to raise the type of assertions to the same semantic type that is normally assigned to questions in alternative-based analyses: $\langle \langle s, t \rangle, t \rangle$.

Recall that a classical proposition is generally thought of as a function from possible worlds to truth values. In particular, the sentence *Mary danced* will denote the set of worlds in which Mary did indeed dance. In Inquisitive Semantics, by contrast, propositions are now considered to be sets of sets of worlds. A run-of-the-mill assertion will then denote the singleton set containing the set of those worlds in which the sentence is true, as shown in (61).

¹⁸ A more general conceptual problem is that, if logics as a theory of truth and entailment is only concerned with propositions, such higher-typed questions would be outside the domain of logical reasoning.

(61) *Mary danced.* $\rightsquigarrow \{\{w | \text{Danced}(\text{Mary}, w)\}\}$

For questions, not much will change under the inquisitive perspective. A question will still denote the set of possible alternative answers that come in the form of sets of worlds, whence the already familiar representation in (62).

(62) *Did Mary dance?* $\rightsquigarrow \{\{w | \text{Danced}(\text{Mary}, w)\}, \{w | \neg \text{Danced}(\text{Mary}, w)\}\}$

With the difference in semantic type gone, questions and assertions must now be distinguished in a purely content-based manner. With propositions constituting sets of sets of worlds, inquisitive semantic approaches define a proposition as *informative* whenever the union of its alternatives does not cover the entire logical space. Conversely, a proposition is *inquisitive* if it contains more than one alternative in its set (of sets of worlds). Given these definitions, questions come out as inquisitive and non-informative, whereas default assertions are non-inquisitive but informative.

An alternative way of thinking about the transition from classical propositions to the inquisitive view on meaning is that linguistic meanings are not only connected to truth and entailment, as in classical theories, but also to the information exchange potential of linguistic expressions. This relates to dynamic theories of meaning, in which meanings are understood in terms of their context change potential (CCPs), as suggested in Heim (1982), Groenendijk & Stokhof (1991), and others. The meaning of linguistic expressions can then be conceived of as a function from context to context, where contexts are typically conceptualized in terms of common ground (CG) information in the sense of Stalnaker (1978, 2002). As laid out above, CG-information can be modeled as a context set (CS), that is the intersection of all mutually accepted propositions from the prior discourse, with some additional representation device for discourse referents and potentially further information. This idea has led to a particularly successful analysis of presuppositions, cf., e.g., Beaver (2001), and of other linguistic phenomena, as summarized, e.g., in Kadmon (2001). Under a dynamic context-based conception of meaning, the CCP of assertions boils down to simple set-theoretic intersection. Given a context set c and some new assertion p , where p is a classical proposition, the new context set c' resulting after the update would naturally be $c + p \rightsquigarrow c \cap p$. For questions, by contrast, the update procedure would appear to be of a fundamentally different nature: Context updating with questions would consist in the creation of a distinct structured entity, a set of alternative possibilities. One might want to limit the alternative possibilities in the question to those compatible with the prior context set c : Hence, for some question q , the update will

yield: $c + q \rightsquigarrow \{a \cap c \mid a \in q\} \setminus \emptyset$, which is the set of context-compatible alternatives a in q . Clearly, the operation $+$ can be functionally incorporated into the denotation of assertions/questions, but we will not be concerned with this step here. Crucially, on standard dynamic treatments, updating with assertions and questions will result in different types of entities, i.e., sets of worlds vs. sets of sets of worlds. Under the inquisitive perspective, however, contexts may generally include not only information about the world, but also *issues*, where an issue is informally understood as some kind of request for information about the world.¹⁹ Hence, given a context set c , that is some set of sets of worlds, the operation $+$ can be understood as an algebraic operation because the output is again a context set c' , a set of sets of worlds, regardless of whether the second argument is a question or an assertion. Depending on the nature of the second argument, the output context set c' may or may not incorporate issues, however.

Various versions of Inquisitive Semantics have been developed in recent years mainly in work such as Groenendijk & Roelofsen (2009), Ciardelli (2010), Ciardelli et al. (2013), Ciardelli & Roelofsen (2011), Ciardelli et al. (2009). The most recent incarnation of the framework, which has the potential for becoming the standard version of Inquisitive Semantics, was mainly developed in Roelofsen (2013), Ciardelli et al. (2017), cf. also Onea (2016). We will first describe some general properties of Inquisitive Semantics that hold in all versions of Inquisitive Semantics, modulo differences in the technical implementation. Special attention will be paid to the treatment of disjunction, indefiniteness and questions. Following this, we will turn to a discussion of technical aspects of the most recent version of Inquisitive Semantics. Finally, we discuss some possible perspectives opened up by Inquisitive Semantics on the classical topics of existential presupposition and exhaustivity inferences.

3.1 *Questions, Assertions and Hybrids*

We have said above that the distinction between assertions and questions in Inquisitive Semantics is modeled in the space defined by two parameters: inquisitiveness and informativeness. Questions are inquisitive but not informative, whereas assertions are non-inquisitive and informative. Of course, this opens up the question of whether other combinations of parameter settings are possible as well. Indeed, the theory also allows for so-called *hybrids*, which are

19 This idea captures the need for representing both questions and propositions in the Stalnakerian model, which was done with the help of the somewhat awkward tuple notation in (6) above.

TABLE 1 Distinctions in Inquisitive Semantics

	Informative	Non-informative
Inquisitive	Hybrid	Question
Non Inquisitive	Assertion	Tautology

both inquisitive and informative, and for *tautologies*, which are neither inquisitive nor informative, as shown in Table 1.

The most interesting category is the category of hybrids, which can for instance be expressed by disjunction: the individual disjuncts constitute alternatives, just as question alternatives generally do in Hamblin-style Alternative Semantics. The representation of the disjunction in (63a) in inquisitive semantics, hence, amounts to (63b). The reader can easily check that (63b) is inquisitive, because it opens up two possibilities, just like questions do. But it is also informative, because the union of the possibilities does not cover the entire logical space: worlds in which Donald does not talk trash and Baptiste does not listen to Bowie are not included. Of course, if the disjuncts cover the entire space of possibilities, as in (64), the result will be a non-informative but inquisitive *Question*.

- (63) a. Baptiste listens to Bowie or Donald talks trash.
b. $\{\lambda w.\text{listen}(\text{Baptiste}, \text{Bowie}, w), \lambda w.\text{talk_trash}(\text{Donald}, w)\}$
- (64) a. Baptiste listens to Bowie or he doesn't.
b. $\{\lambda w.\text{listen}(\text{Baptiste}, \text{Bowie}, w), \lambda w.\neg\text{listen}(\text{Baptiste}, \text{Bowie}, w), \}$

In the same vein, the existential quantifiers in assertions, and indefinites in general, are treated as alternative- or hybrid-generating devices. In fact, indefinites generate exactly the same alternatives as *wh*-words in standard question theories, as shown in (65). Assuming that the contextual domain contains the same three singers from above, namely Bowie, Cash and FatBoySlim, the denotation in (65b) will be identical to (12c).

- (65) a. Baptiste listens to somebody.
b. $\{\lambda w.\text{listen}(\text{Baptiste}, x, w) | x \in C\}$

Notice that these are general formal properties of the inquisitive semantic framework and not necessarily empirical claims about specific natural lan-

guage utterances containing indefinites or disjunction. In particular, it is generally assumed that the assertion operator in any assertion will trigger a non-inquisitive closure operation, which turns hybrids into assertions, whereas in interrogatives some version of a non-informative closure operator will make sure that a question denotation is received. Crucially, the alternative-generating function of indefinites and disjunction is a deeper formal property that need not be reflected in the final semantic representation of the utterances in question. Still, this deeper property is sometimes reflected in the morphology of natural languages. Firstly, Zimmermann (2009) and Haida (2011) observe that question operators and disjunction are morphologically related in Chadic languages. Secondly, AnderBois (2012, 2014) and Onea (2016) show in detail how the well-known indefinite-interrogative affinity in natural languages (cf. Haspelmath 1997, Bhat 2000) receives a natural account in Inquisitive Semantics.²⁰ The following examples illustrate the morphological affinity between indefinites and interrogatives. In German, for instance, unaccented *wh*-words have an indefinite interpretation whenever they do not undergo *wh*-movement, as shown in (66). Moreover, *wh*-words can morphologically combine with *irgend* to yield non-specific, epistemic indefinites, cf. (66c).

- (66) a. *Peter hat wen gesehen.*
 Peter has WH.ACC seen
 ‘Peter has seen someone.’
- b. *Wen hat Peter gesehen?*
 WHO.ACC has Peter seen
 ‘Whom did Peter see?’
- c. *Peter hat irgendwen gesehen.*
 Peter has IRGEND-WHO.ACC seen
 ‘Peter has seen some guy or another.’

In (67), from Lakhota (Siouan) (Bhat 2004, 226), the constituent question only differs from the assertion involving an indefinite pronoun in that the former features an additional morphological question marker. In (68) from Kannada (Dravidian) (Bhat 2004, 226), by contrast, a specific indefinite pronoun is morphologically derived from a bare interrogative by adding a disjunctive suffix.

20 See also Kratzer & Shimoyama (2002) and Haida (2007) for similar ideas on indefiniteness, and Alonso-Ovalle (2005) and Winans (2019) for a similar treatment of disjunction. For a recent analysis see Roelofsen (2019).

- (67) a. *suka ki taku yaxtdka he*
 dog the SOMETHING bite INT
 ‘What did the dog bite?’

- b. *suka ki taku yaxtdke*
 dog the WHAT bite
 ‘The dog bit something’

- (68) a. *ra:ju ellige ho:da*
 Raju where went
 ‘Where did Raju go?’

- b. *ra:ju ellig-o: ho:da*
 Raju where-or went
 ‘Raju went somewhere’

Similar phenomena have been observed for a range of typologically unrelated languages, including Belorussian, Finnish Sign Language, Eastern Pomo (Pomoan), Thai and many others, cf. Gärtner (2009). From the perspective of Inquisitive Semantics, these typological observations are not only unsurprising, but actually expected; cf. Onea (2016) for further discussion.

3.2 *Downward Closure, Composition*

We now turn to a more technical discussion of the most recent version of Inquisitive Semantics. In the original implementations of Inquisitive Semantics, also known as the language *Inq_B*, alternatives were largely similar to alternatives in Hamblin-semantics. However, while Hamblin-semantics was not per se concerned with logical properties of questions, the type-unification of assertions and questions in Inquisitive Semantics immediately opened up the question of how logical relations ought to be handled in this framework. For instance, one would need a systematic treatment of entailment and logical operators such as negation, conjunction, disjunction and the like, in this new framework. Inquisitive Semantics has taken care of this based on logical considerations. Consider, for example, the notion of entailment. Empirically, (69a) entails (69b) and (70a) entails (70b).

- (69) a. *Donald lied.*
 b. *Donald lied or talked trash.*
- (70) a. *Donald lied and talked trash.*
 b. *Donald lied or talked trash.*

One way of defining entailment such that (69) comes out as a valid entailment is provided in (71), which is the very kind of entailment relation known from classical possible world semantics.²¹ Crucially, however, for (70), this definition of entailment does not work: the subset relation in (71) is not satisfied because (70b) contains no alternative amounting to the classical proposition that Donald lied and talked trash. To fix this, a more involved theory of entailment is required, e.g., the one in (72). Now, the only alternative in (70a) is indeed a subset of one of the alternatives in (70b): the set of worlds in which Donald lied and talked trash is a subset of the set of worlds in which Donald lied.

(71) Entailment: α entails β iff $\alpha \subseteq \beta$

(72) Entailment: α entails β iff for all $s \in \alpha$ there is an $s' \in \beta$ such that $s \subseteq s'$

While there is nothing intrinsically wrong with an entailment relation defined as in (72), the system will end up having mathematical properties that are not well-understood. This is because it does not allow for an analogous algebraic setup (e.g., a Boolean algebra as classical logics would have it). This problem can be remedied, though, by applying *downward closure* under subset-relation for propositions. In other words: whenever there is an alternative possibility in a proposition, all subsets of that possibility will also be included in the proposition. The downward closure operation is defined in (73) and exemplified in (74):

(73) Given a set of sets A , the downward closure of A will contain all elements of A and all sub-sets of the elements of A and is noted as: $A \downarrow := \{a \mid a \subseteq b \text{ and } b \in A\}$

(74) $\{\{w_1, w_2\}, \{w_1\}, \{w_2\}, \{w_3\}, \emptyset\} = \{\{w_1, w_2\}, \{w_3\}\} \downarrow$

Downward closure leads to a denotation of simple polar questions as downward-closed sets of sets of worlds, in which the maximal alternatives are identical to the alternatives in Partition Semantics and in Hamblin-semantics. In addition, though, the subsets of these maximal alternatives are also included.

21 In Inq_B one also has to differentiate between maximal and non-maximal alternatives, so what we say here is an oversimplification. However, it will suffice to expose the argument we are trying to make. A detailed discussion of technical aspects of various versions of Inquisitive Semantics goes beyond the scope of this section.

- (75) $\llbracket \text{Did Mary dance?} \rrbracket = \{\{w \mid \text{Danced}(\text{Mary}, w)\}, \{w \mid \neg \text{Danced}(\text{Mary}, w)\}\} \downarrow$

Assuming downward closure, the notion of entailment is again definable as in the simpler and more natural (71). Furthermore, because propositions now no longer have holes in the space of possibilities they define, they naturally lead to an algebraic logical setting. In particular, the logical operators from Inquisitive Semantics thus defined will give rise to a Heyting algebra, as also known from intuitionistic logics, cf. Roelofsen (2013). Moreover, this innovation allows for a novel compositional system explored in Ciardelli & Roelofsen (2015) and Ciardelli et al. (2017). In what follows, we briefly present a few aspects of this system, together with two sample derivations:

- (76) Lexical denotations

- a. $\llbracket \text{John} \rrbracket_g = \mathbf{J}$
- b. $\llbracket t_i \rrbracket_g = g(i)$
- c. $\llbracket \text{sing} \rrbracket_g = \lambda x. \{\{w \mid x \text{ sings in } w\}\} \downarrow$
- d. $\llbracket \text{love} \rrbracket_g = \lambda x. \lambda y. \{\{w \mid y \text{ loves } x \text{ in } w\}\} \downarrow$
- e. $\llbracket \text{who} \rrbracket_g = \lambda P_{\langle e, T \rangle}. \bigcup_{x \in D_e} P(x)$
- f. $\llbracket \text{everyone} \rrbracket_g = \lambda P_{\langle e, T \rangle}. \bigcap_{x \in D_e} P(x)$

- (77) Functional application $\llbracket \alpha \frown \beta \rrbracket = \llbracket \alpha \rrbracket (\llbracket \beta \rrbracket)$ iff $\llbracket \beta \rrbracket$ is in the domain of $\llbracket \alpha \rrbracket$.

- (78)

- a. $\llbracket [\text{loves Mary}] \rrbracket = \lambda y. \{\{w \mid y \text{ loves } \mathbf{M} \text{ in } w\}\} \downarrow$
- b. $\llbracket [\text{John} [\text{loves Mary}]] \rrbracket = \{\{w \mid \mathbf{J} \text{ loves } \mathbf{M} \text{ in } w\}\} \downarrow$

- (79)

- a. $\llbracket [\text{loves Mary}] \rrbracket = \lambda y. \{\{w \mid y \text{ loves } \mathbf{M} \text{ in } w\}\} \downarrow$
- b. $\llbracket [\text{Who} [\text{loves Mary}]] \rrbracket = \bigcup_{x \in D_e} \{\{w \mid x \text{ loves } \mathbf{M} \text{ in } w\}\} \downarrow =$
 $= \bigcup \{\{\{w \mid x \text{ loves } \mathbf{M} \text{ in } w\}\} \downarrow \mid x \in D_e\} = \{\{w \mid x \text{ loves } \mathbf{M} \text{ in } w\} \mid x \in D_e\} \downarrow$

We refrain from discussing the further complexities of the general inquisitive system, including the workings of logical operators as well as the non-inquisitive and non-informative closure operators, etc. The primary purpose of this illustration was to show that once downward closure is applied, the composition procedure with alternatives in Inquisitive Semantics is much more similar to classical alternative-based systems and Structured Meanings. This follows from the fact that downward closure makes it possible to use virtually the same algebraic operations known from classical systems, the only difference being that whatever role was played by simple worlds earlier is now played by possibilities, i.e., sets of worlds.

Before closing this section, it is important to note that the inquisitive system discussed here readily allows for the application of *predicate abstraction*. This sets it apart from the Hamblin-alternative system in Kratzer & Shimoyama (2002), for which predicate abstraction turned out to be a serious problem on principled grounds, cf. Hagstrom (1998), Shan (2004), Novel & Romero (2010), Charlow (2014).

3.3 *Further Perspectives: Highlighting and Exhaustiveness*

In this section we discuss two possibilities for dealing with two central empirical problems with wh-questions within inquisitive semantic systems: the question of whether or not wh-questions have an existential presupposition, and the issue of the inherent (non-)exhaustivity of questions.

As discussed above, it is commonly assumed that a wh-question can only be felicitously asked if the corresponding existential inference is in some sense satisfied in discourse. We have also argued above that it might not be a good idea to treat such existential inferences with wh-questions as presuppositions in general. In what follows, we briefly indicate how a particular version of Inquisitive Semantics may provide a formal handle for modeling the informal notion of existential *supposition* suggested above, following Onea (2016). The core assumption is that the formal inquisitive representation makes it possible to register asymmetries between the different question alternatives: In brief, some question alternatives are marked as more equal, or more privileged, than others by *highlighting*.

There are several ways of thinking of highlighted alternatives in Inquisitive Semantics. The idea was first introduced in Roelofsen & van Gool (2010). It was further elaborated upon in Farkas & Roelofsen (2015), where it was shown to be useful for capturing the semantic contribution of polarity particle *yes/no*-responses. Moreover, it was discussed in Herbstritt (2014) and Roelofsen et al. (2019), who argue that embedding verbs may also interact with alternative highlighting; see also AnderBois (2019) for the role of highlighting in the inter-

pretation of biased polar questions. More generally, the addition of highlighting gives Inquisitive Semantics a higher level of expressivity, which potentially equals the expressive power of Structured Meanings approaches, cf. Cross & Roelofsen (2016).

The notion of highlighting was introduced to capture a distinction between two dimensions of meaning for natural language expressions, mainly in the domain of interrogatives. The regular dimension of meaning includes the standard alternative states that jointly form a proposition, according to whatever counts as a proposition in some particular version of Inquisitive Semantics. The highlight dimension, by contrast, would only host those alternatives which are special, i.e., the highlighted ones, similar to the distinction between focus semantic value and ordinary semantic value in Rooth (1992). Highlighting does not so much distinguish between questions proper, but between the various modes of presenting them, i.e., between the meanings of different interrogatives with the same basic question meaning. For instance, the two interrogatives in (80) will end up having distinct denotations with highlighting, but they would nevertheless denote the same question at the level of ordinary meaning.²² Speakers may then employ the different ways of highlighting, i.e., formally expressing, a given question in order to indicate their assumptions regarding their world and regarding the development of the future discourse.

- (80) a. $\llbracket \textit{Did Mary dance?} \rrbracket = \{\{w \mid \text{Dance}(\text{Mary}, w)\}, \{w \mid \neg \text{Dance}(\text{Mary}, w)\}\} \downarrow$
 $\llbracket \textit{Did Mary dance?} \rrbracket^H = \{\{w \mid \text{Dance}(\text{Mary}, w)\}\}$
 b. $\llbracket \textit{Did Mary not dance?} \rrbracket = \{\{w \mid \text{Dance}(\text{Mary}, w)\}, \{w \mid \neg \text{Dance}(\text{Mary}, w)\}\} \downarrow$
 $\llbracket \textit{Did Mary not dance?} \rrbracket^H = \{\{w \mid \neg \text{Dance}(\text{Mary}, w)\}\}$

Alternatively, highlighting may be formally implemented by inducing a partial order on the alternatives in a proposition, cf. Onea (2016). Regardless of the specific formal implementation chosen, highlighted alternatives are typographically marked by underlining, as in (81), in which the possibility consisting of worlds 1 and 2 is highlighted, whereas the possibility consisting of world 3 is

22 Note that it does not really matter whether the highlighted dimension involves downward closure or not, as the highlighted meaning component does not constitute a question in the first place.

not. Moreover, it is easy to define a $\mathcal{H}$ operator that extracts the highlighted alternatives from a proposition.

$$(81) \{ \{w_1, w_2\}, \{w_3\} \} \downarrow$$

AnderBois (2019) employs the formal tool of highlighting in his analysis of biased negated yes/no-interrogatives, and Roelofsen et al. (2019) use highlighting in order to account for the puzzling fact that some embedding verbs (e.g., *surprise*) can select for wh-interrogatives but not yes/no-interrogatives as semantic complements.

The notion of highlighting is also useful in rethinking the problem of the alleged existential presuppositions with wh-questions. Onea (2016), for instance, proposes that the classic alternatives in a question proposition are highlighted, whereas the corresponding subsets derived from downward closure as well as the additional negative alternatives are not highlighted. For example in a minimal model in which Mary danced in worlds w_1 and w_2 whereas John danced in worlds w_3 and w_4 and nobody danced in worlds w_5 and w_6 , the meaning of the wh-interrogative *Who danced?* with highlighting amounts to (82), and the meaning of the respective positive polar question amounts to (83).

$$(82) \llbracket \textit{Who danced?} \rrbracket = \\ \{ \{w_1, w_2\}, \{w_3, w_4\}, \{w_5, w_6\} \} \downarrow \\ \{ \underline{\text{Mary danced}}, \underline{\text{John danced}}, \text{Nobody danced} \}$$

$$(83) \llbracket \textit{Did Mary dance?} \rrbracket = \\ \{ \{w_1, w_2\}, \{w_3, w_4, w_5, w_6\} \} \downarrow \\ \{ \underline{\text{Mary danced}}, \text{Mary did not dance} \}$$

Under the revised analysis with highlighting, wh-interrogatives denote proper questions and not hybrids: their denotation covers the entire logical space, just as polar questions do. However, the existential inference does now have a distinguished formal status: It equals the union of highlighted alternatives, as shown in (84).

$$(84) \text{info}_{\llbracket \textit{Someone danced} \rrbracket} = \bigcup \mathcal{H}(\llbracket \textit{Who danced?} \rrbracket)$$

The fact that the existential inference can be recovered from the denotation of wh-interrogatives allows for the formulation of a somewhat weaker discourse rule governing the felicity of such interrogatives. This revised rule accounts for

the properties of the existential inference observed with *wh*-interrogatives as follows:²³

(85) **Felicity of questions**

a. *The ignorance rule:*

No alternative of a question *q* should be known to be true in a context *c*.

b. *The soundness rule:*

The union of highlighted alternatives of a question *q* should be known to be true in a context *c*.

In short, *wh*-interrogatives do not trigger a real existential presupposition, but the soundness rule requires that, in order for them to be felicitous in a given discourse context, this discourse context should be such that it guarantees that at least the union of the highlighted alternatives of the question holds true. In most cases, this will amount to the same predictions as the assumption that *wh*-questions have an existential presupposition. However, crucially, failure to comply with this rule does not result in a bona fide presupposition failure, but rather amounts to uncooperative behavior on the side of the speaker, just as the informal notion of *supposition* from above would imply.

Turning to exhaustivity next, the central topic of the above discussion was whether Partition Semantics, on the one hand, or Hamblin-Karttunen-style questions, on the other, are better suited for modeling the meaning of interrogatives in natural language. In particular, as the two approaches involved two fundamentally different notions of what questions are, the exhaustivity debate in sub-section 2.3.2 seemed to have far-reaching consequences, e.g., concerning the semantic type of questions. In Inquisitive Semantics, questions no longer have a designated type. In fact, all propositions are of the type $\langle\langle s, t \rangle, t\rangle$, and the distinction between questions and assertions has nothing to do with semantic types. This means that the issue of whether questions are modeled as partitions, i.e., as maximal non-overlapping alternatives, or as a set of overlapping alternatives, is ultimately irrelevant for the question of whether the respective semantic objects qualify as questions or not. Put differently, Inquisitive Semantics is as such compatible both with a notion of exhaustive questions and with a notion of non-exhaustive questions; moreover, it also allows the option that

23 Notice that the soundness rule leads to problems with polar questions, which we ignore here. The reader is referred to Onea (2016, p. 95) for discussion.

both types of questions exist. In light of the observable variability in the interpretation of embedded interrogatives, we consider this a real advantage of this framework.

Indeed, the flexibility of Inquisitive Semantics casts an entirely new light on the exhaustivity debate from above. In particular, the empirical arguments against the analysis of interrogatives in Groenendijk & Stokhof (1984) put forth in Heim (1994) and subsequent literature never claimed that truly exhaustive readings of questions do not exist. The point was, instead, that Partition Semantics does not have the means to capture non-exhaustive readings, which were likewise claimed to exist. However, on the Inquisitive Semantics perspective on what a question is, the most natural conclusion would be that *wh*-interrogatives are systematically ambiguous between exhaustive and non-exhaustive readings, as argued in Onea (2016). If so, the occurrence of markers of non-exhaustivity and exhaustivity as discussed in Beck & Rullman (1999) no longer constitutes a conclusive argument against some particular theory of questions or other. Instead, such markers can be analyzed as explicit markers of disambiguation between exhaustive and non-exhaustive readings of *wh*-interrogatives. Delegating a further investigation of this issue to future research, what is essential for the purpose at hand is the fact that Inquisitive Semantics allows for a more flexible view on questionhood than any of the theories discussed in section 2, matching the observable semantic flexibility of interrogatives in natural languages.

3.4 *Structured Meanings and Inquisitive Semantics*

A central motivation for casting the analysis of questions in the framework of Structured Meanings as discussed in section 2.2.3 was that classical alternative-based approaches offered no way of distinguishing between plain polar questions and alternative polar questions created by disjunction of the polar opposites. This was shown in (25), repeated as (86). In particular, while polar questions allow for both *yes* and *no* answers, the corresponding alternative questions do not, even though they are expected to have the same semantic representation involving the same two alternatives in (87).

(86) a. *Does Baptiste have a favorite Bowie song or doesn't he?*

(i) # *Yes.* / # *No.*

(ii) *He does(n't).*

b. *Does Baptiste have a favorite Bowie song?*

(i) *Yes./ No.*

(87) $\{\lambda w. \exists x. \text{fav_song}(\text{Baptiste}, x, w), \lambda w. \neg \exists x. \text{fav_song}(\text{Baptiste}, x, w), \}$

Versions of Inquisitive Semantics with highlighting now provide an easy way for distinguishing between the two question types, cf. Farkas & Roelofsen (2015), e.g., by assuming that the explicitly mentioned alternatives are highlighted. Hence, (86a) can be represented as in (88a) and (86b) as in (88b). The different distribution of polar response particles in (86a) and (86b) is accounted for if these particles require for only one of the two polar alternatives to be highlighted.²⁴

- (88) a. $\{\lambda w. \exists x. \text{fav_song}(\text{Baptiste}, x, w), \lambda w. \neg \exists x. \text{fav_song}(\text{Baptiste}, x, w)\}$
 b. $\{\lambda w. \exists x. \text{fav_song}(\text{Baptiste}, x, w), \lambda w. \neg \exists x. \text{fav_song}(\text{Baptiste}, x, w)\}$

Summing up, the formal device of highlighting seems necessary to give Inquisitive Semantics the same level of expressivity attained by Structured Meaning approaches. At the same time, highlighting introduces additional structure into propositional meanings, thereby making it not very different when compared to Structured Meaning approaches. Moreover, there is nothing specific about Inquisitive Semantics when it comes to highlighting. As highlighting introduces an extra layer of meaning by imposing additional structure, it is in principle possible to add such a structural element to any of the frameworks discussed above.

The fact that the operation of highlighting is – in our view – not specifically tied to Inquisitive Semantics beyond historic contingency, leads us to the conclusion that some additional structure has to be imposed on propositional meanings, irrespective as to whether Inquisitive Semantics is assumed as a framework or not. From this perspective, it would appear necessary to revive the discussion of how Structured Meaning approaches relate to alternative based approaches.²⁵

4 The Question under Discussion and Its Role in Grammar

A major appeal of the concept of questions, beyond constituting a natural denotation for clausal or nominal (concealed) interrogatives, lies in the fact that questions have been argued to play an important role in the structuring of

24 Intuitively, the response particles are illicit in (86a) because it is not clear to which of the two highlighted alternatives they refer.

25 The idea that hybrid versions might be necessary has also recently been discussed in the literature (cf., e.g., Onea (2013) and more recently Zimmermann (2017) from a different perspective.)

discourse, and that theories of grammar must take this discourse-structuring role into account for capturing the conventional meaning of various grammatical and lexical items, such as, e.g., focusing, contrastive topics and focus particles. In this section we consider these phenomena alongside a discussion of the more general role played by questions in a general theory of discourse.

4.1 *Questions and Information Structure in Discourse*

This sub-section provides a short overview of a prominent formal analysis of the role of questions in structuring discourse and on the effect that questions in discourse have on the formal realization of linguistic information and on its interpretation. The *questions under discussion* (QUD)-analysis was originally developed in Roberts (1996) for *focus*. It has been subsequently refined in Büring (2003) for *contrastive topics*. See also Onea (2019) and Riester (2019) on the role of QUDs in structuring discourse. In the idealized version of Roberts (1996) (see Onea 2016, ch. 8 for critical discussion), a discourse sets out from the most general question possible, which is *What is the way things are?*. This very general super-issue is subsequently elaborated on by a sequence of less general questions, ever more specific sub-questions, and by the answers to these questions. Such more or less specific questions and answers are taken to be positioned at higher and lower levels in a hierarchical discourse structure. Following Büring (2003), this hierarchical organization of discourse in terms of questions, sub-questions, and answers can be modeled in the form of *D(iscourse)-trees*, in which the various moves (sensu Carlson 1982) and sub-moves are organized in a tree structure. An example is the D-tree in (89):

Following Büring (2003, p. 517f.), the well-formedness of such D-trees is subject to two kinds of constraints. First, it is subject to constraints concerning the propositional content of a move. A move must be informative relative to the CG, that is, it must provide new information which is not previously entailed by the common ground; and a move must be relevant relative to the Question under Discussion (QUD) (Roberts, 1996), that is, it must provide at least a partial

answer to the question of relevance at any given stage of the discourse. Defining relevance to the QUD is a non-trivial issue, but simplifying somewhat it can be understood as choosing an alternative from the space of alternatives opened up by the QUD, if the discourse move is an assertion. If the move is a question, it must be a sub-question of the QUD in order to be relevant. The sub-question will then become the new QUD in the evaluation of the next move.

The second kind of constraint, which is of relevance here, is subsumed by Büring (2003, p. 518) under the notion of congruence. Congruence constraints concern the relation between the grammatical realization of a discourse move (e.g., its accenting pattern in pitch accent languages), on the one hand, and its position in the D-tree, on the other. If the accent pattern of a move does not correspond to its local discourse context, i.e., its local D-tree environment as defined by the hierarchically stacked QUD-sequence, the move will be infelicitous.

Another important formal concept is that of a *discourse strategy*, which refers to a particular question-based subpart of a D-tree, the parts of which are structurally related by dominance and (possibly) linear precedence. Discourse subparts corresponding to strategies are devoted to the settling of a particular issue of interest. For instance, the rightmost branching in the D-tree in (89) represents a strategy devoted to gaining relevant information concerning the food supply at the party. Büring (2003, p. 518) gives the following broad definition of discourse strategy in terms of D-trees and discourse moves:

- (90) Any subtree of a D-tree which is rooted in an interrogative move is a strategy.

According to this definition, any subpart of a D-tree that is dominated by a question move counts as a strategy. Importantly, according to Roberts and Büring, the concept of a discourse strategy is of crucial importance for the structural analysis of information structure. Discourse trees, may, however, be more complex than this, see, e.g., sub-section 4.3 and Onea (2016) for the notion of *potential questions* and Groenendijk (2015) for dependent questions as additional elements in discourse trees; see also Velleman & Beaver (2016) for a recent overview.

It is important to see that the D-tree-based concept of strategic discourse in Roberts (2012b) is meant to capture the structural development of entire discourses, irrespective of their length. By contrast, other researchers assumed a more local span of discourse trees. In particular, Farkas & Bruce (2010) and subsequent research assume that QUDs are formally represented only in a very limited segment of the discourse, namely as part of what they call the *table*.

Question issues and assertions come onto the table prior to the final updating of the common ground. Once an issue is fully answered, it is resolved and removed from the table. As we will see below, this alternative view makes no difference for any predictions concerning information structure, since tables are assumed to be strategic in exactly the way suggested above. Crucially, however, the more general discourse structuring role of QUDs no longer forms part of the theory under the more local table-perspective.

4.1.1 Focus

The most basic discourse strategy is the *question-answer-strategy*, which in English and other pitch accent languages are formally marked by focus accenting of the constituent corresponding to the questioned element in the QUD. The question-answer strategy is illustrated for the two cases in (91) with the corresponding D-trees. Falling focus accent is indicated by capitals and ‘\’:

- (91) a. *Who listens to Bowie?*
 |
 BAPTISTE\ listens to Bowie.
- b. *Whom does Baptiste listen to?*
 |
 Baptiste listens to BOWIE\.

Both D-trees in (91) comply with the definition for strategies in (90), as both are rooted in a question, the respective QUD. Consisting of only two elements, question-answer is the minimal instantiation of a discourse strategy, ignoring borderline cases of individual question moves. An important consequence of the linguistic marking of question-answer by means of focus accenting is that the relevant QUD at the root of the strategy can be, and often is, left implicit. Because of the tight connection between discourse structure and linguistic marking, here in the form of focus accenting, the resolution of the relevant QUD depends on the location of focus accent in the asserted answer. Focus marking thereby imposes a formal constraint on the QUD, which can be modeled along the lines of the informal Focus Principle in (92) from Beaver & Clark (2008, p. 37):

(92) Focus Principle:

Some part of a declarative utterance should evoke a set of alternatives containing all the Rooth-Hamblin alternatives of the [QUD].

Following Rooth (1992), Roberts (1996) and Beaver & Clark (2008), it is commonly assumed that the primary discourse-semantic function of focus accenting consists in establishing a formal congruence between an assertion A and its corresponding QUD. In alternative semantic terms (Rooth, 1985, 1992), focus congruence in matrix clauses spells out as in (93):

(93) Matrix Focus Congruence:

FOC in α indicates a strategy in D iff there is a question under discussion Q such that $Q \subseteq \llbracket \alpha \rrbracket^F$

The question-answer sequences in (91) are well-formed in accordance with focus congruence, as shown in (94), given that the focus value makes reference to any element in the discourse domain:

- (94) a. $QUD_{(91a)} \subseteq \llbracket BAPTISTE \backslash \textit{listens to Bowie} \rrbracket^F$;
 where $\llbracket BAPTISTE \backslash \textit{listens to Bowie} \rrbracket^F =$
 $\{\lambda w.\textit{listen}(x, \textbf{Bowie}, w) | x \in D_e\}$
 b. $QUD_{(91b)} \subseteq \llbracket \textit{Baptiste listens to BOWIE} \rrbracket^F$;
 where $\llbracket \textit{Baptiste listens to BOWIE} \rrbracket^F =$
 $\{\lambda w.\textit{listen}(\textbf{Baptiste}, x, w) | x \in D_e\}$

Conversely, focus congruence rules out the infelicitous question-answer sequences in (95) as constituting incongruent discourse moves, since $QUD \not\subseteq \llbracket \alpha \rrbracket^F$:

- (95) a. (i) QUD: *Who listens to Bowie?*
 (ii) #A: *Baptiste listens to BOWIE* \.
 $\{\lambda w.\textit{listen}(x, \textbf{Bowie}, w) | x \in \textit{Person}\} \not\subseteq$
 $\{\lambda w.\textit{listen}(\textbf{Baptiste}, x, w) | x \in D_e\}$
 b. (i) QUD: *Whom does Baptiste listen to?*
 (ii) #A: *BAPTISTE \textit{listen to Bowie}*.
 $\{\lambda w.\textit{listen}(\textbf{Baptiste}, x, w) | x \in \textit{Singer}\} \not\subseteq$
 $\{\lambda w.\textit{listen}(x, \textbf{Bowie}, w) | x \in D_e\}$

Notice that, in reality, it may not always be possible to unambiguously deduce the relevant QUD from the intonation of a given utterance. For instance, certain accent patterns allow for focus projection Selkirk (1984, 1995), which means the position of the nuclear pitch accent is compatible with different focus structures. Because of this and the congruence rules from above, this accent pattern will correspondingly be compatible with different QUDs. As a result,

focus and implicit QUDs will often come out as under-specified. More generally, the phenomenon of focus underspecification, which is much more prevalent in non-pitch accent languages (see Zimmermann & Onea 2011 and references there), can be taken to impose an upper limit on the extent to which QUDs can be left implicit in natural language discourse. Hence, one can think of the discourse function of focus as not actually individuating, but rather as constraining the range of possible QUDs that the speaker may want to address.

In other cases, it is not even clear how the signaling of a QUD can be considered the main semantic contribution of focus marking, for instance when considering cases of embedded focus, as shown in (96). We will return to such limits of QUD-based accounts in section 5.

- (96) a. *If BAPTISTE\ talked to Donald, the campaign will be happy.*
 b. *Every reporter who talked to DONALD\ decided to quit their job and become a FARMER\.*

4.1.2 Contrastive Topic

The way in which information structure can be used to mark strategies in discourse trees goes beyond the effects of focus marking. Consider, for example, the multiple wh-question in (97a). This question is modeled in Hamblin-semantics as in (97b). According to what was said above, the only information-structural configuration indicating that an utterance is an answer to this question must involve double focus, as in (97c), with the focus semantic value in (97d). This is because the focus semantic value of the answer has to be a superset of the question denotation.

- (97) a. *Who listens to whom?*
 b. $\{\lambda w.\text{listen}(x, y, w) | x \in \text{PERSON}, y \in \text{SINGER}\}$
 c. *BAPTISTE\ listens to BOWIE\.*
 d. $\{\lambda w.\text{listen}(x, y, w) | x, y \in D_e\}$

Intuitively, however, (97a) can also be answered as in (98) below, with a so called B-accent (Jackendoff, 1972) on the subject. We mark B-accents with / and capital letters, and furthermore say that they mark contrastive topics.

- (98) *BAPTISTE/ listens to BOWIE\.*

This observation raises a problem for any plain focus-based analysis of discourse: Not only is (98) an empirically acceptable answer to (97a), but (98) is incorrectly predicted to be a straightforward congruent answer to (99), rather than to (97a). This follows from the focus congruence rule from above and from the observation that *Bowie* is the only constituent carrying a falling pitch accent, which is indicative of focus. Empirically, though, it turns out that (98) is only felicitous as an answer to (99) if the discourse contains some salient question such as (100), which has or will be addressed in the vicinity of (98). The discourse activation of such questions is normally realized by a contrastive (topic) accent on the subject *Baptiste* in (99).

(99) *Whom does Baptiste listen to?*

(100) *Whom does X listen to?*

Where X is some salient individual.

In order to account for these problematic findings, it was proposed that the contrastive topic-focus accenting pattern of (98) marks a more complex discourse strategy. This more complex strategy consists of a higher super-question, an intermediate level of two or more sub-questions, and a bottom level of assertive answers to these sub-questions. Each of these answers provides a complete answer to its respective sub-question, and a partial answer to the super-question. As shown in Büring (2003), the discourse-semantic function of contrastive topic-focus accenting in assertions does not only consist in pointing to the existence of the higher super-question. More importantly, the exact location of contrastive topic and focus accenting also provides information regarding the way in which this super-question splits up into individual sub-questions. Contrastive topic-marking thus provides additional information on how precisely the discourse proceeds from the less specific super-question to the partial answers, mediated through an intermediate level of sub-questions. This is illustrated in (101).

(101) a.

As shown in (101), there are several ways of splitting up the general super-question into smaller, more manageable sub-questions, each forming a different instantiation of the *question-sub-question* strategy. The only strategy to which contrastive topic marking in (98) is congruent is the one in (101a). Notice that in (101a) the focus congruence rule above is satisfied independently of contrastive topic marking: the object *Bowie* carries falling pitch accent indicative of focus, making it congruent to the object sub-question one layer up. So the only thing left for the contrastive topic to mark is the more complex tree structure beyond focus marking. In order to do so, Büring (2003) introduces an additional layer of meaning, the so called CT-semantic value. For our example (98) this amounts to the value in (102):

$$(102) \quad \{\{\lambda w.\text{listen}(x, y, w) | y \in D_e\} | x \in D_e\}$$

Technically, the CT-semantic value consists of a set of sub-questions, here of the form *Whom does Baptiste, Alfons, Caesar, ... listen to?*, exactly one of which is focus-congruent to the assertion. The role of this set of questions is firstly to indicate what kind of sister-questions to the immediate question under discussion are available in a valid discourse strategy. Taking up the issue of exhaustivity from section 3, notice that reference to these alternative sister questions makes CT-marked assertions invariably come out as non-exhaustive. They constitute partial answers to the super-question. By flattening out all the sister questions, the CT-value signals what this super-question of the entire strategy is, resulting in D-tree structures as in (101a). While the technical implementation in Büring (2003) is a bit more complex, we will keep the discussion at this intuitive level here for reasons of expository simplicity.

As already discussed in connection with the question-answer strategy, the explicit linguistic marking of the question-sub-question strategy in the form of CT-marking allows for a certain degree of implicitness regarding the relevant questions and super-questions under discussion. In particular, either the super-question or else the sub-questions of such strategies can often be left implicit in natural discourse as the intended discourse strategy is sufficiently marked by means of CT-marking and CT-congruence anyway; see Onea (2013, p. 157) for discussion of this point. Implicit sub-questions are illustrated in (103a) from Buring (2003, p. 526), and the presence of an implicit super-question is illustrated in (103b).

- (103) a. Q: *What did the popstars wear?*
 A: *The FEMALE/popstars wore CAF\tans.*
 implicit sub-Qs: What did the male/female/transgender popstars wear?
- b. Q: *How did you do in the exam?*
 A: *Well, I/ PAS\sed.*
 implicit super-Q: How did you students all do in the exam?

The recoverability of super-questions and sub-questions through CT and focus marking in the corresponding answer provides a powerful tool for the efficient organization of natural language discourse, which does not rely on an explicit spell-out of each and every question that plays a role in the hierarchical structuring of the discourse.

The analysis of contrastive topic-marking as pointing to a particular question-sub-question strategy in the current discourse has been extended and modified in various ways in the literature. For instance, drawing on data from the Northern Nigerian language Ngamo (West Chadic, Afro-Asiatic), Grubic (2015, p. 184) proposes to extend the question-sub-question approach to instances of aboutness topics (Reinhart, 1981). The empirical basis for this claim comes from the distribution of the background marker *i/ye*; cf. Grubic (2015) for extensive discussion. This marker is often found on the backgrounded part of a declarative assertion, in the extended verbal projection of the clause. In such cases it presupposes the existence of a focus-congruent QUD in the preceding discourse, which is addressed and answered by the utterance containing *i/ye*, cf. (104).

- (104) *Kule sal-ko=i bano a Potiskum*
 Kule build-PFV=BM house at Potiskum
 ‘Kule built a HOUSE in Potiskum.’
 presupposed QUD: What did Kule build?

Interestingly, the same *i/ye*-marker shows up regularly with aboutness topics, from which Grubic (2015) concludes that the *i/ye*-marker in the topic-containing utterance indicates, again, the presence of some salient QUD (or more precisely: of a QUD on some salient topic situation) in the discourse. Consider (105), which contains two instances of *i/ye* in the background and on the left-dislocated aboutness topic, respectively.

- (105) *Yura=i esha si=i Kule*
Yura=BM call.PFV 3SG.M=BM Kule
 'As for Yura, Kule called him'

In the analysis in Grubic (2015, p. 184), the *i/ye*-marker on the topic points to a higher super-question of the form *What is the way of things with Yura?*, or *What's new about Yura?*, which is then elaborated on by the more specific sub-question *Yura, who called him?*

- (106) *What's new about Yura?*
 |
 Yura, who called him?
 |
 Yura, Kule called him.

Notice that the relatively high position assumed for aboutness-topic questions in the D-tree is confirmed by the typological observation that aboutness topics are often held constant across more than one consecutive sentence (Givón, 1983). In the view sketched in Grubic (2015), the consecutive sentences in such sequences would then address individual sub-questions of the super-question identified by *i/ye*-marking on the topic, which would all be questions about (the situation containing) Yura. The proposed extension of the question-super-question strategy to instances of aboutness topics, at least in Ngamo, has potentially far-reaching theoretical consequences. First, it would seem as if the *i/ye*-marker in Ngamo differs from focus and CT-accent in English in that it can indiscriminately point to immediate QUDs or to some higher super-question in the D-tree, depending on its relative position in the clause. This is somewhat reminiscent of the reanalysis of contrastive topics as hierarchically stacked focus operators in intonation languages in Wagner (2012). According to this reanalysis, any form of pitch accenting points to the presence of some QUD in the discourse, where the status of the indicated QUD in the D-tree depends on the relative structural position of the (focus or CT) accent in the clause. The findings are also reminiscent of the Japanese topic-marker *wa*, which dou-

bles as a marker of aboutness topics and as a marker of contrast. These notions are commonly associated with the notions of focus and contrastive topic. (c.f. Tomioka 2008, Vermeulen 2012). In view of such seeming parallels, it would appear mandatory to address in more detail the question of what, if anything, distinguishes aboutness topics from contrastive topics in a question-based discourse analysis, if both point to the existence of some higher super-question in the D-tree. Given the D-tree in (106), the main difference would seem to lie in the fact that aboutness topics do not make available alternative (sister) questions at the intermediate level. More generally, if correct, Grubic's analysis would make questions as semantic objects the unifying tool for structuring information in discourse across the distinct information-structural categories of focus-background and topic-comment (Krifka, 2008). With aboutness topics in the picture, the need for additional semantic devices for capturing information-structural effects would be greatly reduced. Still, there may be independent effects induced by the given-new distinction in language, which will be discussed in sub-section 5.2.

4.2 *Questions and Particles in Discourse*

Apart from information structure, another domain in which QUDs and question strategies have been prominently exploited for analyzing phenomena at the semantics/pragmatics interface is the meaning contribution of different kinds of particles. The discussion in this sub-section is mainly centered on focus particles because these appear to encode a direct dependency on the question under discussion as part of their lexical meaning. Moreover, there is a long research tradition on focus particles. In addition, we will take a brief look at contrastive particles and some other discourse particles.

Above, we adopted, without much discussion, the Roothian Alternative Semantics analysis of focus, which crucially relies on the concept of a focus semantic value. This focus semantic value introduces a second layer of meaning that utterances have in addition to their standard ordinary (truth-conditional) semantic value, and it lends itself easily for modeling question-answer congruence patterns (Rooth, 1992, 1996). Historically, though, the modeling of question-answer congruence was not the chief motivation for Alternative Semantics. The main empirical reason for the development of a compositional semantics for focus was the phenomenon of focus-sensitivity or association with focus, as illustrated in (107).

- (107) a. *Donald only said BAD\ things about Hillary.*
 b. *Donald only said bad things about HILLARY\.*

In a context in which Donald said bad things about many people including Ted, Hillary and Bernie, but he does not say anything good about Hillary, sentence (107a) would be true, whereas (107b) seems plainly false. Yet, the only difference between these sentences consists in the placement of the focus accent. Closer scrutiny shows that such hard-wired truth-conditional or presuppositional effects of focus marking are rare. In fact, they appear to be limited to a fairly small set of focus particles and syntactic constructions. The relevant particles include exclusive *only*, scalar *even* (as shown in (108) from Beaver and Clark 2008) and additive *also*, which are all said to associate with focus. Focus sensitive syntactic constructions include *it*-clefts (Velleman et al. 2012), see below in this section, and counterfactual conditionals. The semantic effects of focus in counterfactuals, which are shown in (109), have first been discussed in Dretske (1972) and more recently in Ippolito (2003) and Ogihara (2013), among others.

- (108) a. *This book is even sold at WAL\ -Mart.*
 (And not only at other, more likely outlets.)
 b. *This book is even SOLD\ at Wal-Mart.*
 (And not only stocked there, as one might have expected.)
- (109) a. *If Bertha had married CLYDE\ she would inherit a fortune.*
 (Bertha married the wrong man.)
 b. *If Bertha had MAR\ried Clyde, she would inherit a fortune.*
 (Bertha is only friends with Clyde.)

Compositional theories of focus interpretation have been developed with the very aim of capturing these effects, see eg. Rooth (1985, 1992) and also Kratzer (1991) for an early overview. Crucially, though, the fact that focus is also used to mark the answer to *wh*-questions seemed to be an incidental side effect and not (in any interesting way) a core part of the theory of association with focus.

This changed with the influential book of Beaver & Clark (2008), who build on the crucial discourse-structuring role of questions in their analysis of focus particles, such as exclusive *only* and scalar *even*. According to this focus-question based analysis, such particles make explicit reference to QUDs as part of their lexical entries. Following observations presented in Beaver & Clark (2003), Beaver & Clark (2008) treat such focus particles as conventionally associating with focus (qua their lexical meaning), in contrast to just freely associating expressions, among which they count quantificational adverbs such as *always*. Freely associating expressions differ from conventionally associating ones in that they make no direct reference to QUDs as part of their lexical

meaning. Instead, the truth-conditions of sentences containing freely associating expressions are at best indirectly constrained by the QUD and/or focus alternatives. For instance, the quantificational adverb *always* comes with an implicit domain restriction in (110). Therefore, the example is not easily interpreted as suggesting that in all situations simpliciter Donald lies. Instead, some salient domain of quantification is required. This domain of quantification can be constrained by what the question under discussion or the focus-background structure of the clause is, as suggested in (111).

(110) *Donald always lies.*

In all situations in D, Donald lies.

In all situations in which he asserts improbable propositions about his past achievements, Donald lies.

(111) QUD: *Does Donald say the truth when he talks about his past achievements?*

ANS: *No. Donald always LIES\.*

By contrast, particles conventionally associating with focus make direct reference to the QUD as part of their meaning. Because focus constrains the QUD under focus congruence, the theory directly predicts association of such particles with focus, even if the notion of focus does not feature in the lexical meaning contribution of such particles. For illustration, we start with the central idea of the QUD-based formal analysis of focus particles from Beaver & Clark (2008). They propose that exclusive particles such as *only* presuppose that there be a true answer to the current QUD, as indicated by the focus of the clause, which must be at least as strong as the prejacent of the *only*-clause. The prejacent is the propositional sentence meaning without the contribution of *only*. In addition, *only* asserts as part of its truth-functional meaning that there is no stronger true answer to the current QUD than the prejacent. The informal semantic concepts of being at least as strong as *p* and not being stronger than *p* are formally captured in the form of the MIN(imality)- and MAX(imality)-operators in the lexical entry of *only* in (112) from Coppock & Beaver (2014, p. 394) (*CQ^S* stands for the current QUD given a particular information state *S*). The formal definition of MIN- and MAX is given in (113):²⁶

26 Notice that the ordering relation in (113) is generally taken to be that of logical entailment. In certain cases, though, the ordering can differ. Consider eg. the sentence *I was looking for the CEO but I only met the secretary*, in which no real exclusive effect arises, but which appears to rank the focus alternatives in terms of relative importance or power. This effect

$$(112) \quad \llbracket \text{only} \rrbracket^S = \lambda p. \lambda w. \text{MIN}^S(p)(w). \text{MAX}^S(p)(w)$$

$$(113) \quad \begin{array}{l} \text{a. } \text{MIN}^S(p) = \lambda w. \forall p' \in \text{CQ}^S[p'](w) \rightarrow p \leq_S p' \\ \text{b. } \text{MAX}^S(p) = \lambda w. \forall p' \in \text{CQ}^S[p'](w) \rightarrow p' \leq_S p \end{array}$$

Since MIN- and MAX-operator are restricted to range over propositions in the answer space of the current QUD (the CQ in (113)), the meaning of exclusives is directly determined by the current QUD. Conversely, since the MIN-component of *only* in (112) is presupposed, this has the effect that exclusives do not always relate to an explicit question in the context, but that the relevant QUD can be left implicit for the hearer to accommodate. Consider for illustration the example (114), in which the *only*-clause – seemingly – provides an answer to the preceding question.

- (114) a. Q: *Whom does Baptiste listen to?*
 $\{\lambda w. \text{listen}(\text{Baptiste}, x, w) \mid x \in \{\text{Cash}, \text{FBS}, \text{Bowie}\}^*\}$
 b. A: *Baptiste only listens to Johnny CASH and David BO\wie.*

The MAX-component of *only* rules out any answers that are stronger than *Baptiste only listens to Johnny Cash and David Bowie*, in our case the proposition that Baptiste listens to all three singers under consideration. The MIN-component, in turn, presupposes that the question has a true answer that is at least as strong as *Baptiste listens to Johnny Cash and Bowie*. Together, the two meaning components yield the proposition that the Baptiste listens to Cash and Bowie and to nobody else. In addition, though, since the MIN-component is presupposed, we have to slightly revise our representation of the current QUD as compared to the explicit question in (114). In particular, the answer space of the current QUD that is actually referenced by the *only*-clause is restricted in such a way that atomic propositions of the form *Baptiste listens to Johnny Cash*, *Baptiste listens to David Bowie*, etc. are no longer included in the question meaning: they are ruled out for being weaker than the prejacent. The open alternatives in the answer space of the current QUD are actually only the following two propositions: *Baptiste only listens to Johnny Cash and David Bowie* and *Baptiste listens to all three singers*. This is a different question than the conventional meaning of the explicit interrogative in (114), which also contains all the atomic propositions. This MIN-driven shift in perspective effectively makes exclusive focus

is commonly treated as the scalar meaning component of *only*; see eg. Coppock & Beaver (2014) and Hole (2015) for discussion of scalar and evaluative meaning effects with *only*.

particles come out as discourse particles in the sense that they often trigger a shift in the background assumptions regarding the current QUD, which must be effected by accommodation on the hearer's side. At the same time, the changed perspective captures the intuition that *only* is indeed often used for signalling that some stronger alternative was expected. The idea that the QUD only contains alternatives stronger than or equal to the prejacent nicely captures this counterexpectational meaning effect, which is also referred to as the mirative nature of *only* cf. Zeevat (2009).

An analysis along very similar lines has been proposed for *it*-clefts in English, German, French, and other languages in Velleman et al. (2012) and Destruel et al. (2015), who suggest that this type of cleft-construction has the same meaning as exclusives like *only* apart from the fact that the semantic status of MIN and MAX meaning component is reversed: In *it*-clefts, it is the MAX component that is presupposed, whereas it is the MIN component which is asserted. This is shown informally in example (115). Importantly, this analysis suggests that *it*-clefts are semantically exhaustive, similar to exclusives.²⁷ Crucially, exhaustivity is derived from excluding stronger propositions in the QUD and not from backgrounding properties of the relative clause. In addition, the relevant QUDs may well come with a very restricted domain, as in (116).

- (115) *It is Baptiste who lives near La Chapelle.*
- a. asserted: The proposition that Baptiste lives near La Chapelle is a minimal true answer to the QUD
 - b. presupposed: The proposition that Baptiste lives near La Chapelle is a maximal true answer to the QUD
- (116) Which one of the well-known weather reporters lives near La Chapelle?

There are many alternative theories of *it*-clefts and related constructions in the literature (cf. Percus (1997), É. Kiss (1998), Buring & Križ (2013), Pollard & Yasavul (2015), to name but a few), and this is not the place to discuss empirical and conceptual differences between them. The idea that clefts and exclusives have the same basic QUD-sensitive meaning, with presupposed vs asserted con-

27 There is a vast body of literature on the question as to whether clefts are exhaustive or not, beginning with Horn (1981), which we cannot do justice here for reasons of space. See Byram Washburn et al. (2019) and DeVeugh-Geiss et al. (2018) for concrete experimental data and Onea (2019b) for an overview of recent experimental research.

tent reversed, opens a fresh perspective on the ways in which grammar reacts to the discourse structuring role of QUDs, even if it has been subjected to some criticism.

The QUD-based treatment of exclusives can be directly extended to scalar particles like *even*, as shown in (108) above, which has been considered an antonym of exclusive *only* by many scholars since Horn (1969). On the QUD-based analysis, which is explicated in Grubic (2019), *even* asserts that the prejacent p is a true answer to the QUD. And it presupposes that the prejacent p is stronger (on some contextually relevant scale) than all salient true answer alternatives in the QUD. This is the MAX-component of *even*, whose formal entry is shown in (117); cf. Grubic (2019) for further discussion. Because their true prejacentes are stronger than all alternative answers activated by the QUD, *even*-clauses are typically used to express that the state-of-affairs reported exceeds all feasible alternatives, for instance in terms of likelihood. This frequently gives rise to mirativity effects (Peterson, 2013), again mirroring the semantic behavior of exclusives.

$$(117) \quad \llbracket \textit{even} \rrbracket^S = \lambda p. \lambda w. \textit{MAX}^S(p)(w). p(w)$$

Finally, we consider recent suggestions that sentences with additive focus particles such as *also* or German *noch* can be conceived of as contributing to an already partially answered QUD, or as re-opening a QUD (cf. Eckardt 2007, Umbach 2012 for German and more generally Grubic 2017). Examples typically discussed in the literature include cases such as (118) from Umbach (2012). As discussed in Grubic (2017), additives allow for extending a previously answered QUD, or to ask a more specific sub-question, thereby making it possible to read-dress QUDs in discourse. For our example, question (118a) is fully answered by (118b) in the first round; however question (118c), using the particle *noch*, re-opens that question with a wider range of alternatives. The particular way in which Grubic models this is that the question re-opened by *noch* is shifted with respect to the topic situation of the previous question. It is the new topic situation that contains the wider set of alternatives that were not considered in the initial answer.

- (118) a. *Wer war gestern auf der Party?*
 Who was at the party yesterday?
- b. *OTto und BRUno waren da.*
 Otto and Bruno were there
 ‘Otto and Bruno’

- c. *Wer war NOCH da?*
Who was noch there
'Who else was there?'
- d. *PAUL war noch da.*
Paul was noch there
'Paul was also there.'

Finally, Zeevat (2019) argues that superlative quantificational particles such as *at least* or *at most* parallel *only* in helping to identify the QUD, sometimes overwriting the overt question in the context.

The second class of particles to be considered are not focus-sensitive in the strict sense, but have nonetheless been claimed to interact with discourse structure in terms of question trees. One such particle, which has received a lot of attention in the literature, is the contrastive particle *but* and its various cross-linguistic counterparts, see Umbach (2005), Jasinskaja (2012), Jasinskaja & Zeevat (2008) and Toosarvandani (2014). The early literature, cf. Grice (1975, p. 44f.), treated the contrastive meaning component of *but* as a conventional implicature on the grounds that a sentence like (119) is strictly speaking not false in the following scenario (at least in the intuition of Grice): Donald said that the company made profit, and this was indeed the case. However, it is not the case that what Donald says is usually true.²⁸

(119) *Donald said that the company made profit but it was true.*

Following Anscombe & Ducrot (1977), three main usages for contrastive *but* have been identified in the literature: it can express counterexpectation, as in (120a), correction, as in (120b) and semantic opposition or contrast, as in (120c), all three examples from Toosarvandani (2014, p. 5). The main challenge in the analysis of *but* is, hence, to capture these various usages and the Gricean intuition that none of the associated inferences are truth-conditionally encoded in terms of asserted content.

- (120) a. *The player is tall, but agile.*
- b. *Liz doesn't dance, but sing.*
- c. *John is tall, but Bill is short.*

28 Later literature has occasionally understood conventional implicatures as something very close to the modern notion of semantic or pragmatic presupposition, cf. Karttunen & Peters (1979), Potts (2005), Schlenker (2010), Sæbø (2010) and others for discussion.

Assuming that discourse is structured in terms of QUDs, Jasinskaja & Zeevat (2008) propose a unified analysis of various usages of *but* and similar particles in Russian, suggesting that they make direct reference to a complex QUD. This idea was further developed in Toosarvandani (2014). According to these authors, *but* has the same truth-conditional meaning as the neutral conjunction *and*, but in addition it comes with a not-at-issue inference.²⁹ This inference is that the QUD addressed by the *but*-conjunct is complex. It contains propositions that vary both in their polarity (like with polar interrogatives) and in the value of one or more of their syntactic constituents (like the alternatives with wh-interrogatives). For (120c) this is the QUD corresponding to the wh-polar interrogative *Who is or is not tall?*, which in our mini-example contains the four propositions shown in (121).

- (121) Who is or is not tall? $\Rightarrow$ {John is tall, Bill is not tall, Bill is tall, John is not tall}.

In addition, the conventionalized use-conditions of *but* require the two conjuncts to denote, or at least entail (Toosarvandani, 2014), doubly distinct propositions in the answer space of this wh-polar interrogative. In the case of (120c), the propositions thus entailed are that JOHN is tall and that BILL is NOT tall (i.e., he is short), respectively. This analysis of semantic opposition expressed by *but* naturally extends to instances of corrective usage of *but*, such as (120b), as discussed in detail in Toosarvandani (2014, p. 21). In this case, the relevant QUD would be *What does or doesn't Liz do?*, and the entailed propositions in the answer space of the QUD would be that Liz does NOT DANCE and that Liz SINGS, respectively.

As discussed in detail in Toosarvandani (2014), however, this analysis of semantic opposition and correction does not generalize to instances of counterexpectational *but* in (120a). In the case of (120a), there is no suitable wh-polar interrogative that would satisfy the question-based use-conditions of *but* from above. In response to this problem, Toosarvandani (2014, p. 25) proposes a more general QUD-based meaning for *but*, which accounts for all its uses:

- (122) $\llbracket \phi \text{ but } \psi \rrbracket =$
 At issue: $\llbracket \phi \rrbracket \wedge \llbracket \psi \rrbracket$
 Presupposition:
 $\exists p : p \in \text{QUD}[\llbracket \phi \rrbracket \Rightarrow p] \text{ and } \exists q : q \in \text{QUD}[\llbracket \psi \rrbracket \Rightarrow \neg q]$

29 We return to the distinction between at-issue and not-at-issue content in section 4.5, below.

Crucially, the two propositions *p* and *q* in the answer space of the QUD that are presupposed to exist in (122) can be the same, as in the case of counterexpectational (120a). Here the question under discussion could be, for instance, the polar question *Is the player clumsy?* and the presupposed *p* would be the positive answer that the player is clumsy. This proposition is (defeasibly) entailed by the first conjunct, and its negative counterpart is entailed by the second conjunct, as shown in (123), from Toosarvandani (2014, p. 27)

- (123) A: *What is the player like? Is she clumsy?*
 B: *The player is tall, but agile.*
 a. The player is tall. $\Rightarrow$ She is clumsy.
 b. The player is agile. $\Rightarrow$ She is not clumsy.

With other instances of *but*, the entailments may involve distinct propositions *p*, *q* in the QUD, thereby also allowing for strong entailments, e.g., with corrective *but* in (120b). For such examples, Toosarvandani assumes (somewhat counter-intuitively) that the negative question *What does Liz not do?* is a suitable discourse antecedent.

- (124) A: *What doesn't Liz do?* i.e. {Liz does not dance, Liz does not sing, ...}
 B: *Liz doesn't dance, but sing.*
 a. Liz doesn't dance. $\Rightarrow$ Liz doesn't dance.
 b. Liz sings. $\Rightarrow$ It is not the case that Liz does not sing.

In recent years, QUD-based analyses have also been proposed for a range of German discourse particles, such as German *überhaupt* 'at all' (Rojas-Esponda, 2014) and *doch*, cf. Rojas-Esponda (2013, 2015). *Überhaupt* is argued to mark a traversing discourse move from a subpart of a discourse-tree, which has been exhaustively dealt with, to one question level higher; *doch* expresses that a previously answered QUD is taken up and answered again in the same way. We briefly consider the suggestion of Rojas-Esponda (2013) for *doch* in what follows. German *doch* and its Dutch counterpart *toch* have been subject to a great deal of attention in the literature, among others by Karagjosova (2004, 2009), Zeevat (2000), Grosz (2010), and Egg & Zimmermann (2012). There appears to be a general consensus that *doch* expresses some kind of contrastive presupposition. Grosz (2010), for instance, argues that *doch* can be used in contexts in which there is a salient focus alternative to the prejacent proposition of the *doch*-clause, and in which the alternative and the prejacent cannot be jointly true. Moreover, the speaker takes the prejacent to be firmly established, so that it is safe to discard the possibility that it is false. Because of this, *doch*-clauses are

commonly used to argue against the validity of the alternative context proposition, giving them their strong discourse-contrastive flavor. This analysis is exemplified in (125) from Grosz (2010):

(125) *Jan muss nicht kochen. Er hat doch abgewaschen.*

J. needs not cook he has doch washed.up

'Jan doesn't need to cook. He has DOCH washed up.'

a. Presupposes that it is uncontroversial that Jan has washed up.

b. There is a salient alternative: Jan needs to cook, and it is assumed in the context that Jan needs not both cook and wash up.

Rojas-Esponda (2013) observes that there are also non-contrastive usages of *doch* in German, such as in (126), which motivate her QUD-based analysis. In particular, she suggests that the contrastive use of *doch*, in which it is used to challenge a salient proposition in context, is but a special case. In the more general case, *doch* challenges the QUD, however. In particular, this means that the QUD addressed by the prejacent of *doch* was already active as an open issue at some point in the previous course of the conversation, when it had already been answered. When *doch* is unfocused, the prejacent answers the previously closed question in the same way as before. When *doch* is focus-accented, however, this indicates that the previously resolved question is now being re-answered in a different way.

(126) A: Did Peter cook the soup by himself?

B: *Ja. Er hat doch den ganzen Abend daran gearbeitet.*

Yes he has doch the whole evening on.it worked

'(Yes.) Peter worked doch all evening on it.'

Before concluding this section, let us turn to some problematic aspects of the treatment of discourse particles in terms of question-based discourse structure. Thereby, we have to distinguish between strictly focus sensitive particles and other particles that have received similar treatments.

In general, the application of the QUD-model to the analysis of strictly focus sensitive discourse particles (as suggested in Beaver & Clark 2008 and much of the subsequent literature) has proven a well-motivated and influential move in formal pragmatics. It is true that there are also problematic issues with the approach, such as the fact that focus particles can be stacked in arbitrary numbers and embedded at any level of one and the same utterance, as illustrated in (127).

- (127) *Only Mary told (even) Peter that if John only kissed those girls who only ate half of their ice cream, Alfred will conclude that he is probably (just) a sexist.*

In this case, it is hard to even consider the question of what a suitable QUD for that utterance might be. While Coppock & Beaver (2012) suggest that so-called *local questions* might help to some extent, the range of such questions and, more particularly, the way in which they relate to the model suggested by Roberts (1996) is not so clear. At least, however, such problems can be isolated and addressed in a precise manner in the QUD-model. Thus, there is hope that they may be dealt with in future developments of the model that focus more on focus embedding and its relation to the QUD. We will return to this issue in sub-section 4.4.

When it comes to QUD-based analyses of other than strictly focus-sensitive particles, the situation is less clear. While the analyses proposed are interesting and open up new perspectives on the old topic of discourse particles, it remains to be seen to what extent they succeed in capturing the empirical data. Regarding the contrastive particle *doch*, for instance, it is not at all clear how the analysis in Rojas-Esponda (2013) would account for the occurrence of *doch* in first-mention all-new sentences, as illustrated in (128). Clearly, the question of how difficult the exam is had not already been answered before the passing out of the sheet in (128a); nor is it plausible to assume that (129a) re-answers the QUD *Who is that person?*. This question simply did not arise before the encounter.³⁰

- (128) A on inspecting the newly passed out exam sheet:

A: *Das ist doch einfach!*

This is doch simple

'This is doch simple.'

- (129) A on unexpectedly encountering a celebrity on the street:

A: *Das ist doch Baptiste Muckensturm!*

This is doch Baptise Muckensturm

'This is Baptiste Muckensturm!'

³⁰ In view of such problems, a more promising line of analysis might consist in assigning *doch* an evidential meaning component, and in lexically specifying that the QUD can be answered by the evidence available to all interlocutors, i.e., either by information previously registered in the CG, or else by perceptual evidence available in the utterance situation.

Similarly, there is at present no sufficiently constrained model of discourse that would make the empirical predictions sufficiently clear. For example, the stipulation in Toosarvandani (2014) that in some cases *but* signals a doubly negative implicit QUD, as in (124), is not problematic in itself. However, there is no well-established criterion to decide whether this stipulation is acceptable. Under which conditions are such peculiar questions licit as QUDs? What makes the situation particularly odd is that the author himself suggests that such questions – when made explicit with overt interrogatives in discourse – exhibit biases that would make them inappropriate in the given contexts.

Summing up, reference to QUDs and discourse structure seems a promising line of attack for capturing the meaning contribution of various kinds of discourse particles. However, it is at present difficult to evaluate whether the advantages of these approaches stem merely from the increase in formal expressive power gained by the new formal tools in the framework, or whether there is indeed a deeper connection between QUDs and particles in natural language that would go beyond strict focus-sensitivity.

4.3 *Potential Questions and Indefinite Determiners*

The way in which questions under discussion and discourse trees have been considered as relevant factors in the explication of the meaning contribution of discourse particles and information structure was mainly in terms of the anaphoric potential of such structures/expressions. In other words, the QUD is relevant for the explication of the meaning of some expression if the expression is anaphoric to the immediate QUD or to some more elaborate discourse strategy with more complex super-questions. However, there is a growing awareness in studies of discourse structure that linguistic expressions in discourse cannot only answer questions but also raise issues. The classical example is the case of disjunction in Inquisitive Semantics, as discussed above. So, if a speaker utters (130), she arguably raises the subsequent issue in (131). Of course, when someone actively utters (130), this typically gives rise to an ignorance implicature to the effect that the speaker does not know the answer to (131). However, the mere fact that this ignorance inference arises systematically can be taken as evidence for the fact that disjunctions raise new issues in need of further specification: For, if the question were not salient after the disjunction, there would be little reason or need to infer that the speaker does not know the answer to it.

(130) *Baptiste or Marietta will win the prize.*

(131) *Who of Baptiste and Marietta will win the prize?*

Of course, disjunctions are not the only expression-type with the capacity of introducing questions to the subsequent discourse. In fact, it is not only linguistic expressions that raise new questions in discourse. World knowledge and general psychological facts about humans can also account for typical discourse continuations that are best modeled in terms of questions. For instance, Onea (2016) argues that question (132a) is significantly less likely than (132b) as a continuation of (132). He suggests that this is due to a general tendency of humans to care about humans in danger, rather than about the velocity that living humans can reach when falling from a high altitude.

- (132) A: *John fell from the window of his flat in the third floor when he was trying to install some Christmas decoration.*
 a. B: *What speed did he reach?*
 b. B': *What happened to him?/Did he survive?*

Despite these contingent links to psychology and subjective world knowledge, it is possible to a certain degree to formulate general rules as to how linguistic expressions can raise questions in discourse. *Erotetic logics* in the sense of Wisniewski (1995) is a general formal approach to this problem, albeit without any claims regarding the grammatical effects that are associated with erotetic properties of discourse. As opposed to this, Onea (2016) argues there to be a class of *potential questions* that play a role in the explication of the discourse-semantic meaning contribution of grammatical constructions.³¹ While being similar to the role of antecedent QUDs in the analysis of particles and information structure, the analysis takes potential questions to stand in a cataphoric relation to the linguistic expression of interest. In particular, potential questions have been used to spell out the meaning of so-called *namely*-constructions, as suggested in Onea & Volodina (2011), and of nominal appositives more generally, cf. Ott & Onea (2014). In both cases, the central idea is that the host utterance, i.e., the matrix clause in (133), licenses a potential question, which is answered by the appositive in the form of a term answer.

- (133) A *well-known reporter, (namely) Baptiste, lives near La Chapelle.*
 a. Host: A well-known reporter lives near La Chapelle.
 b. Potential question: Which well-known reporter lives near La Chapelle?
 c. Term answer: Baptiste.

³¹ See AnderBois (2019) for related ideas on the interpretation of polar interrogatives.

In the above example, it is the indefinite expression *a well-known reporter* that seems to license the potential question answered by the appositive. The informal idea that there is a grammatically conventionalized connection between indefinites and potential questions is captured by the formal notion of primary potential questions, as defined in (134) from Onea (2016, p. 14):

- (134) A potential question *q* licensed by some utterance *u* in some context *c* is a primary potential question (PPQ) licensed by *u* in *c*, iff the set of highlighted alternatives in *q* is compositionally derived/made salient by *u*.

According to this definition, a primary potential question is a question which is generated during the semantic composition of the meaning of some linguistic expression, regardless of whether the expression actually ends up denoting a question or not. Following the assumption in Onea (2016) and elsewhere in Inquisitive Semantics that indefinites and disjunction introduce alternatives in the course of the semantic composition, we conclude that disjunction and indefinites systematically license primary potential questions. Importantly, Onea (2016) argues that speakers seem to be well aware of the fact that indefinites and disjunction have this property. As a result, they may be prone to reacting to the future fate of the potential question made salient in discourse by these linguistic triggers. While the situation is not overly complicated with disjunction, because of the ignorance implicature discussed above, a whole range of possibilities arise for indefinites as triggers of potential questions. For instance, the speaker may want to signal that she can answer the respective specificational question (even without providing an explicit answer), or that she is either willing or unwilling to discuss the specificational issue at hand, among other possibilities. One such continuation comment is formally explicated in (135).

- (135) *Some woman danced. And, by the way, if you were to ask which woman danced, the answer would be highly relevant for the topic of discussion.*

Onea (2016) postulates that such (classes of) potential question comments can become grammaticalized in the meaning of specialized indefinite determiner series. On this view, the function of specialized indefinite determiner series consists in signaling whether the speaker is able or willing to disclose the answer to a potential specificational question, or whether he considers this question relevant. The discourse-semantic function of such specialized indefinites does not only consist in the introduction of new discourse referents, as

postulated in dynamic accounts of meaning. But in addition, they also provide information about the future development of the discourse.³²

By way of example, consider a well-known indefinite determiner series from Russian, the *koe*-series. In particular, the indefinite determiner *koe-kakoj* must take widest scope, and it always signals that the speaker is able to, but is not willing to disclose the identity of the individual under discussion. This is shown in (136), from Onea & Geist (2011). These semantic properties of *koe-kakoj* follow immediately from a simple lexical meaning of *koe* as commenting on a potential question, as suggested in Onea (2016, p. 307) and given here in (137).

- (136) *Kazhdij student voschischchaetsja **koe-kakim** profesorom.*
 Every student admires KOE-which professor
 'Every student admires a certain professor the speaker can identify, but is not willing to.'
- (137) *Koe* signals that the speaker is not willing but able to answer the primary specificational potential question triggered by the corresponding indefinite.

Of course, there are some more technicalities required to make sure that the presence of the primary potential specification question triggered by the indefinite will also guarantee widest scope for that indefinite in the respective utterance; see also AnderBois (2012) for discussion. While we will not enter the discussion of these details here, the easiest way to conceptualize them is based on the fact that *koe* provides a speaker comment on a (potential) question. Since speaker comments tend to have widest scope, often being conventional implicatures in the sense of Potts (2005), this means that there must also be a corresponding question accessible to them at that high scope level. This in turn means that no logical operator may interact with that question, thereby limiting its scope to an embedded environment.

While Onea (2016) extensively argues that this kind of approach generalizes to other indefinite determiners as well, specifically also to so-called epistemic indefinites that tend to have narrow scope under some operators and express some kind of speaker-uncertainty regarding the intended referent such as Romanian *vreun*, the Russian *-nibud* series and others (cf. Farkas 1997, 2002, Pereltsvaig 2008, Alonso-Ovalle & Menéndez-Benito 2013, Kratzer & Shi-

32 Somewhat similar ideas about the cataphoric potential of referential expressions have recently been explored in Chiriacescu & von Heusinger (2009) and Chiriacescu (2011).

moyama 2002, Fălăuş 2009 and others), we will not consider such cases here, because the technicalities involved go beyond the limits of this paper.

Summing up, the question-based approach to the meaning contribution of indefinites seems to come with a number of virtues. Among these is, most notably, the fact that the approach directly incorporates the cross-linguistic observation from section 3 above that indefinites and *wh*-words tend to be morphologically related across languages. Under such an approach, the discourse-semantic meaning contribution of indefinite determiners consists in a comment on the basic question (= a set of alternatives) they introduce into the semantic composition. From this perspective, it is thus entirely expected that indefinite determiners derive morphologically from question interrogatives. Still, our worries concerning the treatment of discourse particles in QUD-based discourse models apply *mutatis mutandis* to the discussion of indefinites as well. Future research on the exact distribution and function of indefinite determiners in particular languages will reveal whether the model can prove itself capable of dealing with a sufficiently large variety of well-constrained data.

4.4 Local Questions

A potential problem for QUD-based accounts of focus accent placement is posed by the fact that discourse-structuring questions are commonly treated as matrix phenomena. As laid out above, questions most typically correspond to requests for information between interlocutors. In spite of this, focus accenting can also be found in embedded sentences. This is the case, for example, when focus appears in conditional clauses, such as in (109a), repeated here as (138) in subsection 4.2. In (139), the focus accent is located inside a relative clause.

(138) *If Bertha had married CLYDE, she would inherit a fortune.*

(139) *Kodjo is keen on buying the fish that the WOMAN cooked.*

The question is, then, what QUDs are actually addressed by the embedded focus markings in (138) and (139), respectively? Intuitively, it is not the question that would emerge from replacing the focused constituent with a *wh*-pronoun in matrix position. As a matter of fact, the corresponding interrogatives are ungrammatical in English, and many other languages, because of the violation of a syntactic island constraint:³³

33 In some languages such as Swedish, *wh*-extractions from islands, especially relative clauses, are acceptable under certain conditions, cf. Engdahl (1980, 1997) and others.

- (140) a. *Whom if Bertha had married she would inherit a fortune?
 b. *Whom would Berta inherit a fortune if she had married?
 c. *Whom is Kodjo keen on buying the fish that cooked?

Clearly, the main interest in (139) does not lie on the woman, but rather on the item to be purchased, the denotation of the complex NP containing the relative clause, that is. This insight is captured in the notion of a *focus phrase* from Krifka (2006a), which refers to the syntactic island containing the focus. In a parallel way, the main interest in (138) seems to be on the conditions under which Bertha would inherit a fortune. In other words, intuitively, the focus embedding utterances in (138) and (139) do not directly address the questions *WHOM did Bertha marry?* and *WHO sells it/the fish?*. This precludes a weakened account of focus accenting in terms of the *Focus Principle* in (141) from Beaver & Clark (2008, p. 37), which says that at least part of an utterance, in this case the embedded clause, must be congruent with a question under discussion.

- (141) Discourse Principle:
 Utterances should be maximally relevant to the CQ.
 Focus Principle:
 Some part of a declarative utterance should evoke a set of alternatives containing all the Rooth–Hamblin alternatives of the CQ.

In view of the problem of embedded focus accents, Zimmermann (2014) proposes a particular question-based discourse-strategy, in addition to *question-answer* and *question-sub-question*. He calls this third strategy *question-restriction*. The core idea of the proposal is as follows: In cases such as (138), the assertion containing an embedded focus answers two questions simultaneously. The two questions stand in question-sub-question relation to each other, whereby the less specific super-question indicates the general line of inquiry and the more specific sub-question restricts the domain of the question under investigation. In other words, question restriction turns a general question into a question with much more restricted alternatives. For our example (138), this would amount to a strategy like the one given in (142), with the net effect that the question alternatives are reduced to (142c).

- (142) a. Super-question:
 Under which conditions would Berta inherit a fortune?
 Question alternatives:
 {Berta would inherit a fortune if her father were a millionaire, Berta would inherit a fortune if her grandfather had married the daughter

of a tycoon, Berta would inherit a fortune if she had married Alfons,
Berta would inherit a fortune if she had married Clyde, etc.}

b. Local sub-question:

Who did Berta marry?

Question alternatives:

{Berta married Clyde, Berta married Alfons, Berta married Baptiste,
etc.}

c. Question-Restriction:

Under which conditions of the restricted kind 'Bertha married
somebody before t_0 ', would Bertha inherit a fortune?

Question alternatives:

{Berta would have inherited a fortune if she had married Alfons,
Berta would have inherited a fortune if she had married Clyde, etc.}

Similarly, the two questions Q' and Q that are simultaneously addressed in the example (139) are given in (143). Here, the function of the local question corresponding to the embedded clause is to narrow down the restriction of the unspecific *wh*-pronoun *what* to the much narrower domain of inanimate things that are cooked by somebody.

(143) Super-question Q' : What₁ is Kodjo keen on buying?

Local sub-question Q : Who cooked it₁?

Q_1 : [What₁ thing such that somebody/who cooked it₁] is Kodjo keen on buying?

A: Kodjo is keen on buying [the fish that the WOMAN cooked]

Recall that Q_1 does not have a direct interrogative counterpart, so that it is not entirely clear to what extent strict compositionality should hold between Q' and the (embedded) local Q . In any event, it seems as if the two questions are fused by filling the implicit domain variable of the matrix *wh*-pronoun *what* with the meaning of the local question modulo binding of the pronoun in the local question by the higher question operator; see Zimmermann (2014) for discussion of this point as well as Dayal (1994) for the mechanism of variable binding in question restrictions.

Interestingly, the structural configuration in Q_1 in (143), in which a question occurs in the restrictor of an interrogative pronoun, exhibits striking parallels to other instances of local questions discussed in Coppock & Beaver (2012). In the cases discussed there, a QUD-sensitive focus particle (*only*) occurs in the restriction of a determiner quantifier in the context of a general complement question introduced by an unspecific *wh*-item such as *who*:

- (144) Q: *Who kept the Dark Lord from returning?*
(Coppock & Beaver (2012, p. 296))
A: *No mere child could keep the Dark Lord from returning.*

Here, the exclusive particle *mere* conventionally associates with a narrow focus (*child*) in the restrictor of the quantifier *no*. On the way to a dynamic semantic analysis in terms of *context change potentials* (CCPs), Coppock & Beaver (2012, p. 297) propose “to introduce a new CQ that takes scope only within the restrictor of [*no*], and remove it and restore the CQ to its prior state once we are ‘done’, so to speak, with the restrictor, modulo any information that we have gained in the process of processing the restrictor. We call these processes question accommodation and question resetting”. Setting the procedural nature of this semantic characterization aside, we observe that this comes close to the idea that embedded focus accents simultaneously answer two questions within a question restriction strategy. A less specific question about individuals (*Who kept the Dark Lord from returning?*) is restricted by a more specific local question about properties (*Which properties does a person have?*), which yields a more specific sub-question with a more narrowly constrained question domain about individuals with their corresponding properties, viz. (145).³⁴

- (145) Q': Who kept the Dark Lord from returning? (= (144))
Q₁: Which person with which properties kept the Dark Lord from returning?

As opposed to the postulated cognitive capacity of humans for inferring and processing layered and embedded sequences of questions, most languages seem to lack the structural means of coding two discourse-related questions in a single utterance. Still, it is worth mentioning that at least some languages appear to have grammaticalized the discourse strategy of question stacking by means of *question-restriction*, at least to a certain extent: Zimmermann (2014) argues at length that so-called partial scope marking constructions with bridge verbs in German, such as in (146) should be analyzed as the overt and transparent expression of question restriction.

One technical advantage of the solution in Coppock & Beaver (2012), is that it allows for a standard question-dependent semantic analysis of exclusive operators, as discussed above.

- (146) *Was glaubt Adele, wer in Paris wohnt?*
 What believes Adele who in Paris lived
 'What does Adele believe? Who lives in Paris?'

In (146), the matrix *wh*-item *was* 'what' introduces an extremely general super-question about propositions of the form *What does Adele believe?*, which is then restricted to beliefs regarding the question *Who lives in Paris?*. This intuition is directly cashed out in Dayal's (1994, 2000) semantic analysis of partial scope marking, in which the embedded interrogative serves as the semantic restrictor of a propositional variable introduced by matrix *was*, which is in full parallel to the account of embedded focus marking from above. We conclude this subsection by observing that the grammaticalization of question restriction in the form of partial scope marking is in part conditioned by structural factors. For instance, Lipták & Zimmermann (2007) show that partial scope marking in Hungarian is much less restricted than in German, owing to a richer functional periphery consisting of CP and FocP. As a result, partial scope marking in Hungarian is also found with restrictive relative clauses in the linguistic expression of question-restriction with individual questions, as discussed in connection with (143) above. Conversely, English differs from typologically similar German in not allowing for partial scope marking at all. The only way of overtly expressing question-restriction in English consists in a sequence of *wh*-questions that apply at different levels of discourse embedding by the addressee, as suggested by the translation in (146).

4.5 *Projection and the Question under Discussion*

Presupposition projection is another phenomenon that has received a somewhat surprising, but in recent years quite influential, treatment in terms of questions under discussion. The problem of presupposition projection, so dubbed in Langendoen & Savin (1971) in the early 70's, concerns the question of whether complex sentences containing one or more presupposition triggers will cumulate the individual presuppositions, or whether the presuppositions can be consumed in some way or other in the process of composition. Originally, Langendoen & Savin (1971) argued that presuppositions from embedded clauses must be cumulated. Hence, all presuppositions were predicted to survive. The subsequent debate saw the emergence of much more complex empirical generalizations, e.g., in Karttunen (1973, 1974), which suggested that presuppositions will invariably survive or project in some environments, so called *holes*, whereas they will be invariably cancelled out in others, so called *plugs*. In a third type of environment, so called *filters*, presupposition projection was argued to depend on further factors of a mainly logical nature. Hence,

in (147a), the presupposition of the embedded clause that Baptiste has or had an umbrella at the relevant time survives the entailment cancelling effects of negation. In (147b), the presupposition is cancelled in the speech report environment. Conditional clauses, by contrast, act as filters, i.e., it depends on their content whether or not the presupposition of the consequent survives. This is shown in (147c) and (147d). In fact, the original projection tests have developed into standard, run-of-the-mill presupposition tests used in the literature, nowadays known under the label *family of sentences* following Chiearchia & McConnel-Ginnet (1990). Put differently, the property of projecting from particular environments is one of the most reliable tests to decide whether an entailment is presupposed or not.

(147) *Baptiste gave his blue umbrella to Marietta.*

Presupposes: Baptiste has a blue umbrella.

a. It is not the case that Baptiste gave his blue umbrella to Marietta.

hole

Presupposes: Baptiste has a blue umbrella.

b. Donald said that Baptiste gave his blue umbrella to Marietta. *plug*

Does not presuppose: Baptiste has a blue umbrella.

c. If he had a blue umbrella, Baptiste gave his blue umbrella to Marietta. *filter*

Does not presuppose: Baptiste has a blue umbrella.

d. If it was raining, Baptiste gave his blue umbrella to Marietta. *filter*

Presupposes: Baptiste has a blue umbrella.

The crucial question raised by the above empirical observations concerned the formal and conceptual explanation of the – at first sight – somewhat odd projection behavior of presuppositions. It is not our aim to cover the various approaches proposed in the literature to tackle this issue. Suffice it to mention that, among others, two ideas have been very influential in the literature.

One idea is that presuppositions have a natural tendency to project, i.e., to be understood as part of the common ground. Whenever their content is already part of the common ground, this natural tendency is trivially satisfied. When it is not, projection amounts to *accommodation*, where accommodation means that the presupposition is simply added to the common ground (Lewis, 1979). Crucially, some complex structural environments can result in the establishment of so-called *local contexts* in various versions of dynamic semantics, where such local contexts can be considered a kind of (temporary) extension of the common ground. Linguistic elements that create such extensions of the common ground include quantifiers, conditionals, negation, verbs

of attitude, etc. With this in mind, in some cases, one can conceive of presupposition accommodation not as targeting the common ground proper, but rather as operating on some local extension of the common ground. Presupposition projection is then blocked whenever a presupposition is not already contained in the common ground, and when the accommodation must operate on some context that is not the overall common ground, i.e., with local or intermediate accommodation. An example is the non-projecting conditional in (147c), in which the presupposition is accommodated to, or bound by the local context set up by the antecedent. Such approaches to local accommodation are prominently discussed in Heim (1992), van der Sandt (1992), Geurts (1998), Beaver (2001) as well as subsequent literature.³⁵

Another idea, going back to Stalnaker (1974) and discussed among others in Kempson (1975), Levinson (1983), Kadmon (2001), Simons (2001, 2004, 2007), is that presupposition projection is not so much a linguistically conventionalized phenomenon, but rather a pragmatic issue that is conditioned by speaker intentions and context. Put differently, some scholars hold that the idea that there are semantic generalizations about presupposition projection is untenable in the face of empirical data, which would seem to require a more liberal, conversational approach to projection.

Another issue in the study of projection concerns the kinds of projecting material. As pointed out above, the notion of projection was originally introduced for presuppositions. However, ever since the famous distinction in Grice (1975) between *what is said* and *what is implicated*, the much-debated notion of so-called *conventional implicatures* entered the scene. Initially, the notion referred to the meaning contributions of particles like *but* and *therefore*, which went beyond what were considered standard truth-conditional effects at that time. The distinction between conventional implicatures and presuppositions is not always clear in the early literature, cf. the classic Karttunen & Peters (1979) and Potts (2005) for a more recent approach. Conventional implicatures can perhaps best be understood as those parts of the conventionally encoded meaning of some utterance which are not part of the main asserted content, but – for some reason or another – are not to be considered presupposed either. Such reasons may include a novelty condition, as is observed for appositives, which, just like presuppositions, seem to project from certain environments,

35 Usually, a strong distinction is made between theories that use Discourse Representation Theory, and theories which use some version of Update Semantics or File Change Semantics. For the purposes of this paper, this is a mere technical distinction that we can safely ignore. Still, we would like to point out that the two frameworks differ in their empirical predictions.

as shown in (148). However, unlike presuppositions, appositives are infelicitous when their content is already part of the common ground, as shown in (149).

(148) *If a celebrity, Donald, will be remembered, it will be for his words.*

Entails: Donald is a celebrity.

(149) a. *There is a celebrity named Donald. The celebrity named Donald will be remembered for his words.*

b. *There is a celebrity named Donald. # Donald, a celebrity, will be remembered for his words.*

Again, the issue of when, how and why conventional implicatures may project is much debated. In response to the empirical facts, some approaches develop a multi-dimensional semantic framework that allows for locally computed meanings to be invisible to certain higher operators, cf. Potts (2005) and Gutzmann (2012). Others have tried to solve the projection problem by assuming that the linguistic expressions triggering the conventional implicature are syntactically not in the scope of the potentially entailment-cancelling operators to start with. This has been proposed eg. for non-restrictive relative clauses and nominal appositions, cf. McCawley (1988), Del Gobbo (2003), Schlenker (2010), Onea (2016). For these scholars, the projection problem is rather uninteresting, as its structural premises are not even met. Yet, if projection is understood as simply being entailed by the common ground, after updating with the host utterance, even these scholars would agree that conventional implicatures tend to project.

Even disregarding the theoretical debates concerning either phenomenon, the question arises as to what may be the deeper reasons for why both conventional implicatures and presuppositions tend to project from under (the apparent scope of) entailment-cancelling operators, such as negation and conditionals.

It has long been (implicitly) acknowledged that the core asserted information of a clause stands in some relation to its focus domain, and also that the background tends to be presupposed, cf., e.g., the explicit theory of focus presupposition in Geurts & van der Sandt (2004). However, the first systematic connection between projection and information structure has been suggested in Simons et al. (2010) and subsequent research. The core idea of their approach is that projection (of any entailment) can take place whenever the relevant entailment is not-at-issue. Thereby, at-issueness is defined as the property of contributing to answering the QUD in (150), following Simons et al. (2010); whereby ?*p* is the question *whether-p*.

- (150) a. A question is relevant to a QUD iff it has an answer which contextually entails a partial or complete answer to the QUD.
 b. A proposition p is at-issue relative to a question Q , iff $?p$ is relevant to Q .

With this in mind, the common characteristic of presuppositions and conventional implicatures is, hence, that they are not typically used to answer the question under discussion. Put differently, presuppositions and conventional implicatures do not conventionally encode projective behavior, but rather a more or less strict aversion towards being at-issue. In a variety of experiments and theoretical studies, Xue & Onea (2011), Tonhauser (2012), Tonhauser et al. (2013), Beaver & Tonhauser (2015) have shown that the conventional level of not-at-issueness varies across categories of projective content, but crucially, so does the projective behavior. Moreover, projection and not-at-issueness arguably correlate.³⁶

This makes the clear prediction that presuppositions do – indeed – fail to project when they are at-issue, as in (151), from Simons et al. (2010). In (151), in particular, the answer does not presuppose that France has a king, according to the authors; cf. also Abrusán & Szendrői (2013) for additional experimental evidence.

- (151) a. *Q: Does France have a king?*
 b. *A: Well, the king of France didn't attend the opening of Parliament.*

Conversely, for some constructions triggering certain kinds of conventional implicatures, it may be hard or even impossible to construct felicitous cases in which they are conceivably at issue and embedded at the same time. As a result, such implicatures will rarely or never project. It is also worth observing that there are many examples, especially with complement clauses of attitude verbs, which show that projection may be blocked depending on the QUD even though it is generally predicted to be possible on standard semantic theories. Consider the web example (152) from Beaver (2010). On the proposed analysis according to which only not-at-issue content projects, the lack of projection is accounted for: The most plausible question under discussion addressed by the

36 Part of the reason why we hesitate to acknowledge a clear correlation despite a number of compelling studies is that it is not entirely clear how one can measure not-at-issueness. Hence, we cannot be sure to what extent existing diagnostics actually measure at-issueness or something merely related to that. Hopefully, future studies can shed light on this issue to a substantial degree.

conditional utterance is the one in (153), which makes the entailment of the complement clause in the antecedent (*that one of our volunteers is charging money*) naturally at issue.

- (152) *If anyone discovers that one of our volunteers is charging money for being a volunteer, please notify me ASAP.*

Does not presuppose: One of our volunteers is charging money for being a volunteer.

- (153) QUD: Do any of our volunteers charge money for being a volunteer?

The evident problem for this type of analysis is that the assertion is not entirely focus-congruent with the suggested QUD. Instead, it would seem that the QUD must be understood as a part of a strategy addressed by the overall assertion, be it in terms of local questions or in terms of question-restriction, as discussed above. Simons et al. (2016) are quite explicit about the idea that projection is both affected by the immediate focus-congruent QUD, as well as by the domain/discourse question that constitutes the overall goal of the current communication in the sense of Roberts (2012a). While this seems to be a necessary assumption for empirical reasons, it does give rise to fundamental questions about the very nature of QUDs and the precise architecture of the overall QUD framework. We discuss some of these issues in section 4.6 and in section 5.

We wish to conclude this section by observing what we take to be an important conceptual ingredient of this approach to presupposition projection. The idea that projection is mediated by at-issueness is intimately related, in our view, to older theories of pragmatic presupposition, and in particular to the idea in Gazdar (1979) that a presupposition disappears whenever the conversational assumptions needed for a felicitous utterance of the assertion would contradict it. While the system in Gazdar (1979) is demonstrably empirically inadequate, this inadequacy essentially stems from the rigidity of the theory – which may have to do with the level of understanding of discourse structure back in the 70s. The general idea is still attractive, however. Consider the example in (154). According to Gazdar, the conditional implicates that the speaker does not know whether John used to smoke, and hence, the presupposition is blocked.

- (154) *If John used to smoke, then John stopped smoking.*

The QUD-based theory of projection tackles the problem from a much more general perspective, but, in a sense, the idea is the same: the QUD represents

the knowledge state of the interlocutors and lack of projection is generally predicted whenever an inference would entail an answer to the QUD. In other words, presupposing that entailment would contradict the openness presumption of the QUD. On the other hand, if the inference were to survive and not be presupposed but rather asserted, it would constitute a natural answer to the QUD, but this would be at odds with the fact that it is simultaneously contained in the scope of an entailment cancelling operator. In other words, entailments triggered in entailment-cancelling contexts cannot survive as at-issue content.

4.6 *Which Question under Discussion Is It?*

Another important problem, already touched upon in passing, pertains to the question of how to identify the question under discussion at any given point in the discourse. This problem is rooted in the double nature of questions under discussion as (the meaning of) grammatical objects, on the one hand, and as discourse-structuring objects, on the other. It has been contended that the question under discussion is (always) that question which is relevant for the grammatical realization of linguistic utterances. At the same time, the notion of question under discussion was introduced as part of a theory of discourse, and the empirical arguments in favor of the existence and relevance of the question under discussion for information structure was always flanked by overt question-answer paradigms. But, on closer inspection, it turns out that the discourse structuring question under discussion and the grammatically relevant question under discussion are not necessarily the same. In the terminology of Roberts (2012a) the grammatically relevant question, which effects, e.g., the accenting pattern of clauses, is called the *congruent question*. By contrast, the mostly explicit discourse-structuring QUD is called the *current question*. This distinction is illustrated in (155) modeled after classical examples from Schmerling (1976). In this example, the current question is the overt question in (155a), whereas the congruent question is only implicit: it is formed by replacing the subject of the answer in (155b) with a wh-word, e.g., *Who won at the lottery?*. Indeed, this congruent question is naturally answered by (155b) as predicted by the focus-based theory from above. Bolinger (1972, p. 640) presents similar examples, which are shown in (156). Again, the (focus) pitch accent on the subjects in the examples in (156) is unexpected in the presence of the overt sentence focus question. But, of course, the accent pattern in (156) would be accounted for if the answer were addressed at an implicit congruent question. Alternatively, one could assume that there are independent information-structural factors that are responsible for de-accenting the VP-material, such as GIVENNESS, to which we turn in sub-section 5.2.

- (155) a. *What happened today?*
 b. *BAPTISTE won at the lottery.*
- (156) a. *Q: What happened to your shop?*
 b. *A: Some BURGLARS broke into my shop last night.*
 c. *A': The POLICE raided my shop last night.*
 d. *A'': Some GANGsters knocked over my shop last night.*

Assuming for now that the congruent question is often covert, or implicit, it follows that it must be accommodated in such cases. Moreover, one would expect that the overt current question and the congruent question should be connected by strict and predictive rules, such that, for instance the unacceptable pattern in (157) is correctly predicted to be unacceptable, whilst the acceptable patterns in (155b) and (156) would come out as licit.

- (157) a. *What did Baptiste win at?*
 b. *#BAPTISTE won at the lottery.*

Preceding sub-sections have made repeated reference to cases in which an implicit congruent question had to be accommodated in the absence of an overt question. In fact, we have also seen cases in which entire strategies needed to be accommodated, by means of a set of grammatically constrained rules. Examples in point were the accommodation of implicit sub-questions in the presence of contrastive topic accents (see examples (101)-(103) in section 4.1.2), on the one hand, and the accommodation of more specific local sub-questions in the case embedded focus accents and embedded focus operators (see examples (142)-(143) in section 4.4), on the other. There is an important difference, though, between these cases, in which information structure or some other grammatical property of an assertion requires the accommodation of some QUD in the absence of an overt question, and cases such as in (155) and (157), in which an overt question is present. In the former case, it seems a mere matter of elegance or higher theoretical ambition to provide rules for merging together one or more accommodated questions in order to convey a sense of coherence or well-formedness of the discourse, as suggested in theories such as Klein & von Stutterheim (1987), van Kuppevelt (1995b) or Onea (2016). But in the latter case, the falsifiability of the entire framework is at stake. After all, the overt questions in (155) and (157) seem to be directly addressed, and also answered, by the subsequent assertions (with the obvious difference that (155) is acceptable whereas (157) is not in most cases). So if these overt current questions are NOT the congruent QUDs, how do we know whether an overt question

in discourse can serve as QUD, and when it cannot? The theory should better provide clear limits as to when and why such grammatically incongruent question antecedents are acceptable.

Consider, for example the perfectly acceptable example in (158) from Kadmon & Sevi (2011, p. 7):

(158) Q: *What's peculiar about Granny's dog?*

A: *She only likes JOHN.*

Assuming Beaver & Clark (2008)'s analysis of exclusive particles as associating with a congruent question, the declarative utterance in (158) cannot function as the direct answer to the overt current question. After all, this current question exhibits wide VP-focus, whereas the answer is preferably interpreted with narrow focus on the object: i.e., while liking John is not the only property of the dog, John is the only contextually relevant individual that she likes. Based on this particular example, Kadmon & Sevi (2011) argue that this observation makes the entire enterprise of analyzing particles such as *only* as associating with QUDs untenable. This is because, according to these authors, the only reasonable question that could be accommodated for saving question-answer congruence, namely *Whom does Granny's dog like?*, is not plausible in this discourse setting. As they put it: "the question *who does Granny's dog like?* is not intuitively salient in the context, or even intuitively raised by speaker B; there doesn't seem to be any prosodic evidence that it is the CQ [...]; and it is not part of an obvious strategy for figuring out what's peculiar about Granny's dog. It rather seems that B simply stated the most peculiar property of Granny's dog that came to mind." (Kadmon & Sevi 2011, p. 8).

This conclusion of Kadmon & Sevi (2011) may be too strong, however, for the strategy of question-restriction suggested in sub-section 4.4 might well apply to such examples. The answer assertion would simply require the overt QUD to be restricted by a local implicit question, a secondary QUD so to speak, of the form *Whom does the dog like?*. A reanalysis along these lines would correctly rule out the unacceptable example in (157), as accommodation of a suitable implicit question is impossible in this case. There is no way in which the object question *What did Baptiste win at?* and the subject question *Who won at the lottery?* could be construed as standing in a hierarchical relation to one another: Neither is a sub-question of the other, and neither narrows down the question domain of the other. To put it differently, what is blocked by the hierarchy constraint on implicit question accommodation via question-restriction are arbitrary shifts in the discourse tree, which would be at odds with the basic pragmatic prin-

ciples of relevance and discourse coherence. At the same time, in view of the criticism voiced in Kadmon & Sevi (2011), it remains true that working out the full details of a theory of local questions and question-restriction is imperative, both in terms of intuitive empirical coverage and formal rigor. See also Büring (2019) for yet another analysis of (158), in which the exclusive particle *only* helps to unambiguously identify the QUD, which – in his account – need not be salient.

As mentioned above, the problem of accommodating implicit QUDs in the absence of an overt question appears to be less dramatic than the accommodation of congruent questions in the presence thereof. However, less dramatic does not mean entirely innocent. To start with, we contend that it will always be possible to find a congruent question for any discourse assertion under any accent pattern, which results in a severe lack of predictive power. This finding echoes Bolinger's negative assessment of the unpredictability of accent patterns. For instance, a suitable congruent question for (159a) would be *Who sang a terrific song?*, whereas the congruent question for (159b) could be *Why was the show great?*, among many other questions with wide sentence focus. Crucially, both sentences make for perfectly fine continuations of the very same discourse starter in (159).

- (159) *The show last night was great!*
 a. BAPTISTE sang a terrific song.
 b. Baptiste sang a terrific SONG.

Without a strong predictive component in question-based models of larger discourse sequences, it is not at all obvious from the explicit linguistic context how speakers decide on relevant question strategies and corresponding accent placements. In (159), for instance, the identical opening sentence sets the scene for numerous potential continuations, each of which coming with a different congruent question and corresponding accent patterns. The situation is exacerbated by the fact that other non-linguistic factors relating to world knowledge, expectability, salience, etc. clearly factor into the determination of accent placement as well. The following examples from Kadmon & Sevi (2011) illustrate the point:

- (160) Context: B is the host of a variety show on TV, which doesn't specialize in anything in particular. It has interviews, performances, etc.
 a. A: *What's happening on your show tonight?*
 b. B-1: PAVAROTTI is singing.
 c. B-2: #Pavarotti is SINGING.

- d. B-3: # *OBAMA is singing*.
- e. B-4: *Obama is SINGING*.

Clearly, the licit default accent patterns in (160) have to do with background knowledge regarding what is to be expected of the respective subject referents (Pavarotti singing) and what is not (Obama singing). While we have already encountered similar examples in (155) and (156), Kadmon and Sevi make a slightly different point: The context in (160) is specifically designed to make accommodation of the questions *Who is singing?* and *What does Obama do?* even more difficult than in the examples above. A theoretical approach based on potential questions as licit discourse moves, such as Onea (2016), would suggest that in such cases, it is not only a question under discussion per se that has to be accommodated. In addition, hearers must accommodate the presuppositions that someone is singing and that Obama is doing something on the show, respectively. It is actually these accommodated presuppositions that license the respective questions. Unfortunately, even this theory does not give a clear account of what would block the accommodation of the alternative infelicitous assertions (160), or of the questions that would license such infelicitous answers.

We tentatively conclude that an adequate model of discourse and accent patterns will have to factor in explicit and implicit questions under discussion, some notion of discourse structure and further components. While we acknowledge the undisputed virtues of various versions of the QUD model, we devote the final section of this overview paper to discussing some of the limitations of the framework in a bit more detail.

5 Limits of the Question under Discussion

In section 4, it was shown that and how a variety of grammatical phenomena can be explained by using the QUD-paradigm. In particular, QUD-based approaches have been successful at modeling phenomena related to information structure, different kinds of particles, and projection phenomena. Looking at discourse structure at large, this naturally leads to the question of whether all kinds of discourse-based phenomena can be explained by recourse to questions under discussion, discourse trees and the like, or whether additional theoretical tools are needed in order to give a satisfactory and predictive account of discourse structure, discourse coherence and accent patterns (in intonation languages). In the final part of the preceding sub-section, we tentatively assess the first of these questions in the negative, suggesting that QUD-based accounts

will need to be enriched with additional factors in order to achieve a satisfactory empirical and theoretical coverage. Moreover, a discussion of the general applicability of QUD-based approaches and their limits must take into account the variety of speech acts in natural discourse, in addition to just questions and answers.

5.1 *The Discourse Structuring Role of Questions*

Theories of discourse structure aim at making transparent the interpretation and internal order of discourse, mostly in terms of truth conditions, context or use conditions and internal structure. Many theories have been put forth to address this general problem, with varying degrees of success and formal rigor. Particularly successful theories include *Segmented Discourse Representation Theory* (SDRT, Asher & Lascarides 2003) and *Rhetorical Structure Theory* (Mann & Thompson, 1988). Both theories incorporate some notion of rhetorical relations, which constitute the glue between separate discourse units. For illustration, consider the toy example in (161). In one natural interpretation, I_1 , π_1 reports an event that happened temporally before the event reported by π_2 . In another interpretation, I_2 , which is dispreferred without context, the cause of the event reported in π_1 is the event or state reported in π_2 . In this case, the temporal order of the events is reversed or backshifted.

(161) [π_1 Courtney left Kurt.] [π_2 Kurt was desperate.]

If we assume that the rhetorical relation between π_1 and π_2 is NARRATION, we will be able to infer from this the temporal order in I_1 . If we assume the rhetorical relation EXPLANATION instead, we can infer the reverse temporal order and the desired causality in I_2 . Moreover, we are entitled to infer NARRATION for I_1 because there is a scriptal information in our domain knowledge that allows us to infer that being dumped by your partner is a good occasion for being desperate; analogous procedures apply for I_2 .

QUD-based approaches offer an alternative view on the structure of discourse. As discussed above, such approaches understand discourse as a mutual enterprise to gain information by answering questions. Here, questions stand either for discourse goals simpliciter (Onea, 2016) or they are a particularly ubiquitous species of a set of general discourse goals (Roberts, 1996, 2012a): when a speaker conveys information to the hearer she should – at least for the sake of general cooperativity in the sense of Grice (1975) and Lewis (1979) – assume that she is actually answering some question that the hearer can be reasonably assumed to entertain. Then, discourse coherence could be captured exclusively in terms of discourse strategies, or, more generally, rules of

connecting questions and answers at various levels of discourse structure. As mentioned above, a prominent way in which questions may connect is that each part of a coherent discourse addresses a (sub-)question that is relevant for answering the superordinate question discussed by the entire discourse at large, cf. Klein & von Stutterheim (1987) and Roberts (1996). Following terminology from Wisniewski (1995), we may call the resulting hierarchic structure the *erotetic structure* of discourse. On this conception, π_2 can be analyzed as answering the question *What happened next?* under the interpretation I_1 , and as answering the question *Why π_1 ?* under the interpretation I_2 . Onea (2019) and Riester (2019) provide explicit discussion of the connection between rhetorical relations and erotetic structure in the formal representation of discourse. Both authors conclude that the content of rhetorical structures can be cast in erotetic question trees. Moreover, Onea (2019) argues that question trees allow for a more fine-grained analysis of discourse phenomena, at least in some cases.

The remaining question is whether this question-based conception of discourse structure can also be applied to larger pieces of text, whilst still making correct predictions about discourse coherence. On closer scrutiny, it shows that theoretical accounts such as Roberts (1996) do not provide a satisfactory, predictive and sufficiently constrained account of even small units of discourse, such as (161). The main reason is that it is not obvious how the question *Why did Courtney leave Kurt?* would be part of a discourse strategy under the interpretation I_2 . As argued in Onea (2013), who analyzes this question as a potential question raised by π_1 , there are only trivial strategies that can accommodate potential questions as strategic discourse moves. Such a strategy could assume that the main discourse question is *What is the way things are?*. Then, *Why was Kurt desperate?* is a sub-question of this super-ordinate question. But by the same reasoning, any question whatsoever could qualify as a licit sub-question to this superordinate question. As a result, any discourse made up of a chain of however loosely related event reports, all contributing partial answers to the big super-question, will be predicted to be strategic in the sense of Roberts (1996). What this shows is that the notion of strategic question-based discourse sensu Roberts (1996) is not identical to the much more constrained notion of coherent discourse: The non-restricted nature of strategic discourse can be, and often is exploited for literary reasons, for instance in the experimental and jumpy prose style and quick perspective shifts of Virginia Woolf, William Faulkner or in the following quote from Sartre's *The reprieve/ Le sursis*, which appears to resist any analysis in terms of strategic question-based discourse:

(162) *"What is the time?"*

"About half past four," Horace Wilson replied.

The old gentleman lifted his wide eyes, laughed a short, genial laugh, and said: "It's very hot."

And indeed a crimson, crackling, glistening heat had descended upon Europe; there was heat on men's hands, behind their eyes, and in their bronchial tubes, and they waited, sickened by heat and dust and fear. In the vestibule of the hotel, reporters waited. In the courtyard three chauffeurs waited, motionless at their steering wheels; on the far side of the Rhine, motionless in the vestibule of the Hotel Dreesen, tall black-clad Prussians waited. Milan Hlinka was no longer waiting. He had ceased to wait two days ago, on that awful, black day, lit by a flash of certainty: "They've let us down!" Then time flowed on once more in its usual random fashion, individual days no longer seemed to exist – there were only next days; henceforward all days would be next days.

SARTRE: *Les Chemins de la Liberté II: Le Sursis*, Translated by ERIC SUTTON

This being granted, it should also be clear that the marked text structure of literary style does not necessarily need to fit the way in which natural language discourse normally proceeds. An important factor for the more constrained nature of spoken discourse seems to lie in the cognitive limitations of the medium typically employed in information exchange, namely spoken language, as opposed to the written medium of literary texts. The two media differ vastly when it comes to processing, working memory, and other cognitive tasks involved in establishing coherence and in monitoring the subsequent development of a discourse. These cognitive faculties are in need of support by other factors such as salience, activation and continued attention, which are typically associated with the information-structural category of GIVENNESS. In sum, there is also a cognitive aspect to the structuring of discourse, which relies heavily, but not exclusively, on the forward-oriented impact of QUDs as an ordering and structure-imposing device. Other factors, such as backward-oriented GIVENNESS may turn out to be equally relevant for discourse structure and discourse coherence; see Erteschik-Shir (2007) for discussion of this point in a slightly different terminology.

In spite of our critical remarks, we would like to mention that the literature offers other attempts at analyzing larger chunks of discourse with the help of question-based structural models, which we will only touch upon briefly. Such attempts include work by Klein & von Stutterheim (1987), who provide an analysis of narrative texts in which narration proceeds by answering questions of the type: *What happened first?* vs. *What happened next?* etc. This idea

was further developed in work by van Kuppevelt (1995b,a), who assumes that the questions addressed by each utterance reflect the topical structure of discourse, and by Onea (2013), who develops the model of van Kuppevelt (1995a) further by defining the notion of potential questions; see above.

It is unclear whether attempts at modeling discourse structure by building exclusively on questions will eventually prove successful. Some models such as Onea (2013) have been spelled out at some level of formal explicitness, but they are very limited in empirical coverage, and way too permissive in order to count as a general theory of discourse coherence. In fact, Onea (2013) observed that according to his model any discourse can receive a coherent interpretation if the interpreter accommodates sufficiently complex structural information. Of course, the usual notion of coherence is overextended in this perspective, paralleling the discussion of Roberts (1996) above. Other models such as van Kuppevelt (1995a) seem intuitive enough to have a wide coverage, but they lack formal explicitness. For dialogues at least, Ginzburg (2012) suggests a computational model that is widely based on the question-answer paradigm, and which has a fair enough empirical coverage. But then again, this model was never meant to have a similar status as SDRT, as a general theory of discourse coherence and discourse interpretation.

Next to the problem of how to relate a series of, often implicit, questions in a meaningful and constrained manner, there are other qualms about the empirical scope of question-based theories of discourse. These worries stem from the essentially illocutionary nature of linguistic utterances. While the inquisitive semantic analysis of questions has succeeded in providing a uniform analysis of declarative assertions and questions, it is unclear how a QUD-based framework can be extended to other speech acts, and in particular to directive, hortative and permissive speech acts, in which the speaker commits either herself, or the addressee(s), or all discourse participants to some social commitment.

Consider, for instance, the limited domain of overt polar interrogatives and the corresponding answers with polar particles. Krifka (2013) discusses cases like (163) with high negation. Here, the speaker arguably expresses a discourse commitment of speaker and/or addressee to not make certain assertions or ask certain questions in the subsequent discourse. In the case of (163), the use of high negation restricts the addressee to a negative answer. A plain positive answer without additional indicators of discourse repair (e.g., particles) is infelicitous:

- (163) *Isn't there a vegetarian restaurant around here?*
 a. *No* (, *there isn't*).
 b. *#Yes* (, *there is*).

In response to this problem, Krifka (2013) proposes a richer representation of discourse structure that consists of so-called *commitment trees*. Such commitment trees register interlocutors' commitments to possible future developments of the discourse, i.e., possible future speech acts, ideally, on a par with non-linguistic social commitments. In the case of (163), for instance, the effect of metalinguistic high negation would be to constrain the commitment space of speaker and addressee such that they will not contain future assertions of the positive proposition in (163), i.e., that there is a vegetarian restaurant around. Krifka calls such assertion-restricting discourse moves *de-negation*. Crucially, whereas Krifka's model also involves question-answer sequences as parts of commitment trees, these only constitute sub-parts of possible commitment spaces, making this model richer and more expressive than the D-trees of Roberts (1996) and Büring (2003).

At present, it is not entirely clear whether question-based models can be extended to handle the range of phenomena Krifka's commitment spaces are intended to cover. Further research is needed in this domain. This being said, QUD-based discourse models can be safely used for the modeling of more local interactions, in the sense of Farkas & Bruce (2010). In such local interactions, the size and content of the QUD-stack is negotiated as part of the acceptance or rejection procedure of utterances that are still on the salient conversational table, and not yet in the broader common ground.

5.2 *GIVENness, Deaccenting and Absence of Focus Marking*

Next to the question of the general applicability and adequacy of QUDs as a discourse-structuring device, there is also the question of whether questions are a sufficient tool for imposing structure, and for inducing coherence in discourse in terms of predicting intonation (potentially even limited to the question answer paradigm alone). The latter is answered in the negative by many scholars, who assume an additional coherence-inducing factor in natural discourse: the information structural category of *GIVENness*, which is cognitively manifest in the form of activation and salience, and which triggers de-accenting of *GIVEN* material (as defined below) in flexible intonation languages such as English, cf., e.g., Selkirk (1984, 1995, 2008), Schwarzschild (1999), Büring (2016) and Büring (2019).

Whilst QUD-based accounts rely heavily on the positioning of the nuclear pitch accent as an indicator of focus and, hence, of the corresponding question under discussion, *GIVENness*-based accounts focus on triggers for de-accenting. Schwarzschild (1999) defines *GIVENness* in terms of referential identity (with individuals) and existential entailments (with predicative and sentential constituents), and treats it more or less as the complementary counter-

part of focus. In other words, GIVEN material is material the existence of which is entailed by previous discourse. Being pre-mentioned is a prominent way to achieve GIVENness. Schwarzschild shows that a GIVENness-based account, which does not rely on focus or QUDs as basic discourse-semantic notions, is capable of accounting for the same basic accent patterns in English, including cases of unexpected or seemingly incongruent accent placement. GIVENness-based accounts are particularly apt at explaining instances of de-accentuation, in which the nuclear pitch accent is realized in a different position from where it would be in a neutral context without GIVEN material. For illustration consider (164), in which the nuclear pitch accent must be realized on the verb in spite of the fact that wide VP or sentence focus is normally indicated by pitch accent on the direct object. The intuitive reason for de-accenting the object *Bill* is that it is GIVEN in the question.³⁷

(164) Q: *What did you do about Bill?*

A: *I INVITED Bill.*

In subsequent work, e.g., Kadmon & Sevi (2011), the notion of GIVENness has been further developed to include an additional notion of p-givenness, which goes back to Prince (1981) and to the notion of *recoverability* from Halliday (1967) and to the notion of *predictability* in Kuno (1972). According to Prince (1981) and Kadmon & Sevi (2011), for a constituent to be p-given essentially means that its occurrence in a certain role or position in the utterance is inferable, or expected, or natural given the preceding context. This reasoning extends to the Bolinger-examples discussed in sub-section 4.6. Intuitively, it is not surprising that such notions can extend the empirical coverage of GIVENness-based theories of accenting in discourse. At the same time these notions were argued above to be independently required for increasing the predictive power of QUD-based theories. Hence, it seems fair to conclude – in spite of the brevity of our discussion – that pure GIVENness-based accounts of accenting run into similar problems as the QUD-based approach.

In response to this unsatisfactory state of affairs, and backed up by novel empirical evidence from fine-grained phonetic investigations, more and more researchers have in recent years adopted the original insight from Halliday (1967), which is also strongly advocated in Krifka (2006b), that both concepts

37 In a QUD-based account, without giving up the general rules of focus projection, one would need to accommodate a more restricted question, such that all alternatives involve both the speaker as subject and Bill as object. See Büring (2006) for critical discussion.

of focus/QUD and GIVENness are independently required for a satisfactory account of accent patterns in English; cf., e.g., Féry & Ishihara (2010), Katz & Selkirk (2011), and Büring (2019).

Part of the empirical evidence which drives researchers to this conclusion comes from the discussion of so-called second occurrence foci, as exemplified in (165). The issue with (165) is that *only* associates with *vegetables* in the example, hence, it is arguably focussed. However, because the expression is GIVEN in the preceding discourse, it cannot carry the main nuclear pitch accent of the sentence, because of obligatory de-accenting of GIVEN material (a stronger grammatical requirement). Instead, the main nuclear pitch accent is carried by the expression associated with the other focus particle, *even*.

(165) A: *Everyone already knew that Mary only eats VEGETABLES.*

B: *If even PAUL knew that Mary only eats vegetables // then he should have suggested a different RESTAURANT.*

Prima facie, this type of example would seem to provide strong support for pure GIVENness-based approaches, suggesting that focus is not a good predictor of accenting after all. However, the empirical facts turn out to be more complex. Closer phonetic scrutiny revealed that the expression semantically associating with *only* – albeit de-accented – is still prosodically realized in a prominent manner by means of prosodic phrasing, or intensity or length; cf. the influential study of Beaver et al. (2006). This suggests that two different factors are responsible for GIVENness de-accenting and for inducing prosodic (focus) prominence, respectively. Perhaps the most successful account of second occurrence focus to date, namely Beaver & Velleman (2011), assumes that the QUD is a necessary but not a sufficient criterion for determining the accent patterns of sentences with second occurrence focus. While being the answer term to a QUD increases the relative importance or at-issueness of an expression, thereby requiring prosodic prominence, there is a second important factor at work: unpredictability. The latter is linked to non-GIVENness or newness and leads to an increase in prosodic prominence as well. In (165), *Paul* is both important and unpredictable, whereas *vegetables* is important, but predictable, which leads to the correct prediction that *Paul* ends up carrying the nuclear accent.

In the same vein, Katz & Selkirk (2011) show that the prosodic realization of focused material (e.g., in cases in which some expression associates with a focus particle) phonetically differs from the realization of plain new material. The examples in (166), from Katz & Selkirk (2011), are instructive and clearly show the point:

(166) a. Focus-new

Gary is a really bad art dealer He gets attached to the paintings he buys. He acquired a few Picassos and fell in love with them. The same thing happened with a Cezanne painting. So he would only *offer [that Modigliani]_F to [MoMA]*. I bet the Picassos would have fetched a much higher price.

b. new-Focus

Gary is an art dealer. Lately he's been very picky about which museum he deals with; he doesn't do business with the Metropolitan or the Guggenheim. He would only *offer [that Modigliani] to [MoMA]_F*. He says that's the only place with a good enough space to hang it in.

c. new-new

Gary was a successful art dealer, and could afford to be pretty demanding with his clients. He would never make a deal unless the price was right and he respected the buyer. He will probably *offer [that Modigliani] to [MoMA]*. But only for a six figure sum.

In the examples in (166), the target sentence *offer that Modigliani to MoMA* appears in the three conditions *Focus-new*, *new-Focus*, and *new-new*. The constituents *Modigliani* and *MoMA* may either express semantic focus, namely when they associate with *only*, or they only constitute plain new information. Depending on what is the case, their prosodic realization differs in terms of duration and the shape of the nuclear pitch accent. Katz & Selkirk (2011) show that, especially in terms of duration, there is a significant difference between new and focussed expressions, even though both are intuitively perceived as prominent. This finding cannot be captured in one-factor theories operating only with focus, or with GIVENNESS, and which have no way of distinguishing between the two conditions. Such theories would incorrectly predict that either focus or being new (=not GIVEN) will influence the prosodic properties of both expressions in a uniform way, across conditions. To our mind, this constitutes solid evidence for the Halliday-Krifka view that both notions are required for an empirically adequate theory of prosody in discourse.

This observation leads to two conclusions: Firstly, to the extent that the notion of focus is connected to answering an (implicit) question, QUD-based elements must form a necessary part of any successful theory of discourse. At the same time, the pure information status of expressions also plays a role, making a mixed two-factor theory mandatory. Some promising attempts towards such a two-factor account are found in recent empirical work by Baumann & Riester (2012), Riester & Baumann (2013) and Riester (2019). The second con-

clusion is that GIVEN material is not necessarily identical to the backgrounded part of a clause; see eg. Grubic (2015) for evidence from Ngamo (Chadic) for differences in the morpho-syntactic realization of GIVEN and backgrounded material, and Büring (2019) for the possibility of non-given backgrounds.

Concluding the discussion of the limits of QUD-based approaches, it seems to us that enough evidence has been given that the notions of QUD and strategic discourse are useful and probably necessary tools in a theory of grammar or, more precisely, of the grammar-discourse interface, especially when it comes to the mapping between information structure and prosody. The development of a unified and empirically grounded framework that would determine the role of the QUD in the structuring of discourse in a predictive manner, constitutes a challenge for further research, however. The obvious and most promising starting point for such a unified framework seems to be a theory of prosody in discourse, at least for free accent intonation languages of the English/German type. While much progress has been made in this regard, we have taken pains to point out that the question under discussion will most likely be only one among several relevant factors in a general theory of prosody in discourse, given the available evidence in the literature. Indeed, the most promising approaches today combine the question under discussion with factors relating to the information status of linguistic expressions (i.e., GIVEN vs. new). However, there are still many gaps in the research on the primitives of such a theory, and the extensive usage of the QUD-paradigm in an unrestricted manner for analyzing more and more grammatical phenomena is not without its risks: Questions are undoubtedly important, but not everything in the proper analysis of discourse.

6 Outlook

This chapter started out with a fairly technical discussion of what questions are and how they connect to the meaning of interrogatives. While questions lack truth conditions by their inherent semantic nature, it was shown that looking at embedded questions makes it possible to study the properties of questions within the general framework of truth-conditional semantics after all. Two important issues discussed were the formal semantic representation of questions and their exhaustivity. While we do not consider the debates on these issues settled, we have tried to show that there is solid evidence in support of flexible theories, which would allow for questions to be either exhaustive or not, depending on context. Moreover, additional factors, such as the semantics of the embedding predicate or the overall utterance context may induce dif-

ferent degrees of exhaustivity. We have argued that Inquisitive Semantics is a suitable, sufficiently expressive model for capturing the semantics of questions, while the Structured Meaning approach remains a viable alternative as well.

In sections 4 and 5, our focus shifted to the role of questions in discourse, starting from the basic tenet that any adequate discourse-semantic analysis of questions must capture the phenomenon of question-answer congruence, often grammaticalized in terms of focus accenting. This caveat led to the introduction of question-based approaches to discourse analysis, according to which (the grammatical realization of) any discourse is shaped and structured by a sequence of interconnected, and often implicit, questions under discussion (QUDs) and their corresponding answers. Crucially, such question-based analyses do not only account for question-answer congruence but can be extended to the analysis of a range of phenomena that do not appear to be connected to questions on first sight. In particular, we showed that question-based approaches allow for the insightful analysis of focus particles, discourse particles, and discourse coherence. Even question-based accounts of the classical phenomenon of presupposition projection appear feasible – again assuming that not only overt but also covert questions play a role in discourse. Emerging research in the question-based framework covers an impressive empirical domain, even though the empirical focus has been on Indo-European pitch accent languages, such as English and German, until quite recently. This being said, some ground-breaking work has recently been put forward, especially in the discussion of at-issue vs. not-at-issue content, that allows for the tackling of languages beyond those usually encountered in formal semantic research. In addition, first attempts have been made to compare the discourse-structuring role of focus and QUDs in non-Indo-European languages that do not rely on pitch accenting for marking focus. Much more cross-linguistic research is required in order to gain a better understanding of the general pragmatics behind QUD-based phenomena across languages. Indeed, we expect that only through the careful cross-linguistic study of languages with more flexible intonation, flexible word order, and with information-structural marking devices different from English or German, will it be possible to tease apart language-specific mechanisms from general, possibly universal pragmatic mechanisms at the interface between questions and grammar.

The subsequent critical discussion of question-based analyses of discourse analyses pointed out some problems with this type of analysis, such as a tendency towards over-generation and, occasionally, a lack in predictive power. In view of these problems, we argued that it is mandatory to come up with a clear empirical basis for identifying the precise predictions of question-based theories of discourse. While the empirical situation is fairly unproblematic in many

cases, we found more reasons to worry in others, especially in cases when the accommodation of congruent questions was possible (or required by the theory) in the presence of a different overt question. We tried to pin down accent placement as a natural way of mediating between the congruent question and the intonation of corresponding assertions. But even in this restricted empirical domain, one-factorial accounts that solely rely on the QUD, and thereby on information structure, are unable to account for the full range of data, just like competing accounts that only rely on information status (especially GIVENness) for predicting accent patterns. Based on such problematic data, Dwight Bollinger argued back in the 70's in his seminal paper against one-dimensional theories of accent in discourse, by showing that the empirical landscape is indeed much more complicated than assumed by such accounts. We tentatively concluded that only two-dimensional models, which rely both on information structure (focus/QUD) and information status (GIVENness) may prove to be flexible enough for capturing what Bollinger meant by a 'mind reader' correctly predicting accent. But, as acknowledged by many scholars in the field, there is still a long way to go in terms of empirical and theoretical work before this goal is reached.

At the same time, there also seem to be inherent limitations that may not necessarily constitute problems for the linguistic analysis of discourse. In fact, it is far from clear whether capturing all the intricacies of discourse in a fully predictive manner is a task for linguistic theory, or at least linguistic theory in isolation. Especially when it comes to inter- and intra-individual variation and change in the use of language, as well as in special kinds of texts, such as e.g. literary writing, it is unclear what the analytical task for linguists would consist in. For instance, it may prove altogether impossible to come up with a clear delimitation between those texts that should constitute the empirical domain of discourse-pragmatic analysis and those which are outside of that domain. Again, more cross-linguistic work may be of help in teasing apart those regularities and rules in the domain of question accommodation that are part of the general pragmatic domain from those that are mere conventions (though not necessarily in terms of linguistic conventions). Alternatively, it may prove fruitful to restrict the application of question-based approaches to much more local discourse contexts, such as individual utterances and question-answer pairs (as has been done in parts of the literature). As shown above, even this more limited task is challenging from an empirical perspective. In any event, as soon as such local accounts allow for the accommodation of implicit questions, the larger questions concerning general constraints on discourse structure will immediately re-enter the picture; for they will in some sense constitute testing grounds for what accommodation steps can be considered licit.

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