Questions: Logic and Interactions

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1 Overview

The early years of the twenty first century have seen an increased interest in Questions. This is partly due to the rise of interest in interaction, where questions play a key role. As components of context, they are significant actors in grammatical phenomena such as ellipsis and focus. They are of fundamental importance in explicating inquiry and of course in question answering.

This update to Jeroen Groenendijk and Martin Stokhof’s 1997 article focuses on the two main areas of logico-linguistic research on questions recently: first, the logic and ontology of questions—what are questions and how do they relate to other semantic entities? Second, questions in interaction—issues such as how questions affect context, why questions get asked, what range of responses—not just answers—do questions give rise to. The boundaries between these two areas is somewhat artificial and, therefore, not easy to demarcate, particularly in an era where meanings are often explicated in terms of context change. A brief indication of other research in the area is provided before the concluding remarks.

∗I am grateful for comments received from Johan van Benthem, Jeroen Groenendijk, Alice ter Meulen, and Andrzej Wiśniewski. Alice and Johan’s patience and encouragement has been of significant help.
2 The Ontology and Logic of Questions

Over the last decade work on the ontology and logic of Questions can be grouped in roughly three groups, though there is considerable variation in approach and assumptions even within the groups. The first group bases itself on the continued development of *erotetic logic*, a logic in which both questions and propositions can figure in premises and conclusions of inference rules. The second approach taking the partition view of questions (Groenendijk and Stokhof 1997) as its inspiration, attempts to integrate questions and propositions in a logic which is minimally distinct from “standard” logics, primarily (a modalized) propositional logic. The third approach, associates interrogativity with the semantic operation of $\lambda$-abstraction.

2.1 Erotetic Logic

Work in erotetic logic stretches back to the Priors and Kubiński in the 1950s. In recent years it has been developed particularly in works oriented towards applications in the philosophy of science and inquiry by Hintikka and his associates (see e.g. papers collected in Hintikka 1999) and works by Wiśniewski and his associates (see e.g. Wiśniewski 2001; Wiśniewski 2003), which have similar applications but also a somewhat more linguistic bent. For this reason I focus on the latter here.

The starting point of *Inferential Erotetic Logic* (IEL) is the mundane but typically neglected observation that questions figure both as premises and as conclusions in inference:

\begin{enumerate}
  \item a. Who should we invite to the conference? Clearly someone with an interesting research agenda. But that raises the thorny issue of where we can find such a person.

  b. Where should we go on holiday? Ideally somewhere closeby with a lot of sunshine. Which raises the issue of—whether there is such a place at all.
\end{enumerate}

An *erotetic inference*, then, takes place when a question is concluded from premises of declarative sentences and/or a question and the task of IEL is to characterize [the concept of] validity of such inferences. Basic notions the
theory explicates are evocation of questions by sets of declaratives and implication of questions by sets of declaratives and questions. The logic distinguishes declaratives (d-wffs) and interrogatives (e-wffs). In general, it adopts a non-reductionist view of questions, remains open to various implementations thereof, as well as maintaining semantic flexibility, as long as truth is definable for d-wffs. On the syntactic level, the formal language assigns to an interrogative $Q$ a set of sentences $dQ$ which are its direct answers. A key component of the analysis is the use of $m(\text{ultiple})-c(\text{onclusion})$ entailment (Shoesmith and Smiley 1978)—the truth of a set $X$ of premises guarantees the truth of at least one conclusion. MC-entailment helps define evocation and erotetic implication:

$$\text{(2) } X \text{ evokes a question } Q \text{ iff } X \text{ mc-entails } dQ, \text{ the set of sentences which are the direct answers of } Q, \text{ but for no } A \in dQ, X \models A$$

Erotetic implication involves each direct answer to the implied question together with the premises mc-entailing a proper subset of the answers to the implying question. So an implied question is potentially cognitively useful relative to the implying question:

$$\text{(3) A question } Q \text{ implies a question } Q_1 \text{ on the basis of a set of d-wffs } X \text{ iff}$$

- for each $A \in dQ$: $X \cup \{A\}$ mc-entails $dQ_1$
- for each $B \in dQ_1$ there exists a non-empty proper subset $Y$ of $dQ$ such that $X \cup \{B\}$ mc-entails $Y$

This leads on to notion of erotetic search scenario (Wiśniewski 2003) — a cluster of interrelated inference chains each of which starts with the same issue, proceeds via a mix of classical deductive and erotetic inferences, and terminates with an answer. The notions provided by IEL have applications that include the characterization of inquiry, the semantics of why questions, the characterization of query responses in dialogue, and proof theory (see e.g. Leszczyńska-Jasion 2009; Urbanski 2001; Wiśniewski et al. 2005).

### 2.2 Interrogativizing Propositional Logic

Over the last decade there have been a number of approaches that strive to integrate questions in ways that require ‘minimal’ extensions to standard
logics. Questions, on these approaches, are of a similar semantic type to propositions, a strategy that brings with it some clear advantages—as well as some risks.

(Nelken and Francez 2002) develop an extensional (or as they later suggest quasi-extensional) approach to interrogatives using a 5-valued logic. This is achieved by interpreting the meaning of questions as elements of type \( t \), and re-interpreting the domain of type \( t \) as a bilattice (Fitting 1991; Ginsberg 1990). The bilattice has 5 truth values: in addition to the standard True and False, construed epistemically, and the reasonably well known Unknown, it has two interrogatively-oriented values Resolved and Unresolved. Valuations can now be extended to epistemic and interrogative operators \( L\phi \) and \( ?\phi \) as follows:

\[
\begin{align*}
(4) \quad & a. \quad v(L\phi) = t \text{ if } v(\phi) = T; \quad v(L\phi) = f \text{ if } v(\phi) \in \{F, uk\} \\
& b. \quad v(?\phi) = r \text{ if } v(\phi) \in \{T, F\}; \quad v(?\phi) = ur \text{ if } v(\phi) = uk
\end{align*}
\]

Answerhood, construed exhaustively, can be defined straightforwardly:

\[
(5) \quad p \text{ answers } q \text{ if whenever } p \text{ is assigned } t, q \text{ is assigned } r.
\]

One potential pay off for such an approach is that by extending the standard truth tables it can provide a relatively simple—without e.g. the complex type raising of (Groenendijk and Stokhof 1989)—account of Boolean operators that applies uniformly to declaratives and interrogatives:

\[
(6) \quad & a. \text{ The machine is broken or does it just need fuel?} \\
& b. \text{ If Millie didn’t break the vase, then who did?}
\]

Of course, with respect to natural language, such an account raises various issues—for instance, why is there no negation of interrogatives or why does a hybrid as in (7b) predicted to be interrogative resist embedding by ‘wonder’. With respect to the former Nelken and Francez offer an interesting pragmatic explanation.

\[
(7) \quad & a. \text{ #It is not the case whether Millie left.} \\
& b. \text{ #Bo wonders that Bo left but who arrived in his place.}
\]
This general approach has been refined and extended in (Nelken and Shan 2006). Here the setting is first order modal epistemic logic (with the spirit of Hintikka and Åqvist hovering in the background.). Questions are identified with (the knowledge of) their exhaustive answerhood conditions, as in (8); though by appropriate type raising the knowledge modality is abstracted over to allow questions to occur embedded.

\[(8)\]  
\(a. \ ?p =_{df} \Box p \lor \Box \neg p \)

\(b. \ ?x.p(x) =_{df} \forall x.\Box p(x) \lor \Box \neg p(x) \)

Nelken and Shan’s account extends the account of (Nelken and Francez 2002), without certain arguably problematic assumptions the latter require. Nelken and Shan propose an interesting notion of question acceptability, building on Groenendijk’s notion of licensing (see discussion in section 3) to predict what question meanings are available in natural language:

\[(9)\]  
A question is acceptable in natural language only if it licenses a non-trivial answer. That is, Q licenses ?A, where A is neither tautologically true nor tautologically false.

This offers inter alia a novel explanation for the limited acceptability of disjoined interrogatives (relating to earlier ideas of Grice 1989 and Simmons 2002). An additional approach, which falls under the rubric of interrogativizing propositional logic is Inquisitive Semantics, discussed in section 3.

### 2.3 Questions as Propositional Abstracts

The view of questions as \(\lambda\)-abstractions (see e.g. Hull 1975; Scha 1983), a view that fell out of the mainstream of linguistic semantics with the rise of the higher order view of questions, has been revived and generalized by Ginzburg and Sag 2000 and by Krifka 2001.

One of the traditional attractions of identifying questions with abstracts has been that they provide the requisite semantic apparatus for short answer resolution (Who left? Bo; Did Bo leave? Yes etc). However, therein also lies danger because this suggests that e.g. unary wh–questions have the same semantic type as properties, which seems counterintuitive given data such as (10):
a. Some man is happy. So we know that happiness and manfulness are not incompatible. # So we know that the question of who is happy and who is a man are not incompatible.

b. A: What was Bill yesterday? B: Happy. B: #The question of who is happy.

Ginzburg and Sag develop their account within the situation theoretic–motivated approach to ontology developed in (Seligman and Moss 1997). The structure they axiomatize, a Situational Universe with Abstract Entities ($SU+AE$) involves propositions and other abstract semantic entities (e.g. outcomes—the denotata of imperatives, facts—the denotata of exclamatives) being constructed in terms of ‘concrete’ entities of the ontology such as situations and situation types. An additional assumption made is that the semantic universe is closed under simultaneous abstraction, a semantic operation akin to $\lambda$-abstraction with one significant extension: abstraction is over sets of elements, including the empty set. Moreover, abstraction (including over the empty set) is potent—the body out of which abstraction occurs is distinct from the abstract. Within such a setting propositions and situation types are naturally distinguished and hence propositional abstracts—questions— are not conflated with situation type abstracts—properties and can be assigned a uniform type. Polar questions are 0-ary abstracts, whereas wh-questions are n-ary abstracts for $n \geq 1$. The fact that questions involve abstraction over propositions receives empirical support from evidence concerning the distribution of in situ wh-phrases in English, where proposition–denoting clauses are the sole environment out of which wh-phrases allow (non-reprise) meanings to emerge.

In subsequent work, the reliance on the situation theoretic notion of abstraction has been eliminated. (Ginzburg 2005) shows how to formulate a theory of questions as propositional abstracts in Type Theory with Records (TTR), a model theoretic offshoot of Constructive Type Theory (Cooper 2005), while using the standard TTR notion of abstraction.

(Ginzburg 1995) argued that exhaustiveness is an agent–specific notion and, consequently, cannot serve as the semantic underpinning of questions. And yet, interlocuters can share intuitions about the coherence of responses to queries. Ginzburg and Sag show how within an SU+AE propositional abstracts can be used to characterize a wide range of notions of answerhood from strong exhaustiveness through resolvedness—which underwrites
the semantics of resolutive predicates—to aboutness, needed to characterize intuitions concerning the coherence of responses to queries. Thus, questions serve to underspecify answerhood.

The fact that propositions are constructed from situations and situation types has a consequence that, in contrast to approaches where questions are characterized in terms of exhaustive answerhood conditions, positive and negative polar interrogatives are assigned distinct denotations. This means that the ontology can explicate the distinct presuppositional backgrounds associated with positive and negative polar interrogatives (Hoepelmann 1983) and can be linked to factuality conditions of negative situation types (Cooper 1998). These contextual differences gives rise in some languages including French and Georgian to distinct words to affirm a positive polar question (oui, xo) and a negative polar question (si, diax). Nonetheless, given the definitions of answerhood available in this system, positive and negative interrogatives specify identical answerhood relations.

(Krifka 2001) develops an account of questions as propositional abstracts within a structured meanings framework (Krifka 1992). Krifka proposes question contents are pairs $< B, R >$, with $B$ a propositional abstract and $R$ a domain for $B$, with $ID$ and $NEG$ in (11b) denoting the identity and negation functions, respectively:

$$(11) \begin{align*}
a. \quad \text{Who did Mary see} &\mapsto \langle \lambda x[\text{see}(x)(M)], \text{PERSON} > \\
b. \quad \text{Did Mary see Bo} &\mapsto \langle \lambda f[\text{see}(B)(M)], \{ID, NEG\} >
\end{align*}$$

The structured meanings framework analyzes the content of declaratives in an analogous fashion, contents having the form $< B, F >$, with $B(ackground)$ a propositional abstract and $F(ocus)$ an entity appropriate as an argument for $B$. A criterion for question-answer congruence as manifested in English by pitch accent placement can then be formulated straightforwardly:

$$(12) \quad \text{A proposition } < B', F > \text{ is congruent with a question } < B, R > \text{ iff } B = B' \text{ and } F \in R$$

Krifka shows that this criterion enables a wide variety of tricky cases of focal pitch assignment to be handled. Such cases of over and under-focussing are difficult for the more coarse grained approaches within the classical Hamblin picture. Krifka further illustrates the need for the fine grain supplied by
propositional abstracts to distinguish the contents of certain classes of alternative and polar questions. He also argues that certain readings of multiple wh-interrogatives involve the specification of functions—where functions are conceived in terms familiar from constructive type theory. Building up such functions, he suggests, requires access to the question constituents and the background of the sentence, as provided by structured meanings.

3 Questions in Interaction

The lion’s share of work on questions in the late 20th century was driven by phenomena centering around embedded interrogatives, due primarily to worries that the unembedded variety are tainted by pragmatic complexity. Recent work, however, driven by the need to tackle dialogue has moved to offer formal accounts of semantic and pragmatic aspects relating to query uses. Sloganistically, one might adapt Hamblin’s famous dictum as follows: *to know the meaning of a query is to understand what counts as a relevant response to that query*. Here ‘relevant’ can be understood in a number of senses, including ‘optimal’ and ‘coherent’.

The approaches surveyed below differ, in part, by their methodology: on the one hand, approaches for which the starting point is a logic (or family thereof) and for which an important constraint is to develop a framework that can accommodate phenomena while deviating minimally from the starting point. An alternative perspective is more driven by empirical conversational phenomena and the need to provide a fairly detailed linguistic analysis—developing a theory of context the metamathematical bounds of which are more open ended.

3.1 QU-D–oriented approaches

One approach to explicating the effect of queries on context has been developed within the KoS framework (Ginzburg 1994; Ginzburg and Cooper 2004; Larsson 2002; Purver 2006; Fernández 2006; Ginzburg 2010; Ginzburg and Fernández 2010) and, independently, by Roberts (Roberts 1996). Common to these approaches is viewing a dynamic and partially ordered repository of questions—Questions Under Discussion (QUD)—as a key component of context.

Work in the KoS framework aims to provide a theory of relevance, here in
the ‘coherence’ sense, that can explain the coherence and interpretability of responses to a query, exemplified in (13). Relevance has a number of aspects that go beyond ‘semantic answerhood’, including metacommunicative (13b), metadiscursive (13c), and genre-based (13d) aspects:

(13) Carla: Are you voting for Tory?
   (a) Denise: I might.
   (b) Denise: Who do you mean ‘Tory’?
   (c) Denise: I don’t know.
   (d) Denise: What voting system is in use?

Pretheoretically, relevance relates an utterance \( u \) to an agent’s information state \( I \) just in case there is a way to successfully update \( I \) with \( u \). Thus, defining relevance involves interplay between semantic ontology, grammar and interaction conventions. This requires a theory that allows such relationships to be formulated. For this purpose Type Theory with Records is employed. This enables simultaneous reference to both utterances and utterance types, a key desideratum for modelling metacommunicative interaction. The formalism can, consequently, be used to build a semantic ontology, and to write conversational interaction and grammar rules.

The main emphasis in this domain has been on explicating two main classes of entities: (a) the dialogue gameboard (DGB), an entity associated with each conversing agent, corresponding in essence to that agent’s record of the publicized aspects of interaction. The DGB is modelled as a record type with fields tracking inter alia turn ownership, shared assumptions, moves, and QUD, and (b) conversational rules, the regularities that describe how conversational interaction changes dialogue gameboards.

A general constraint (\( \text{Q(uestion)}\)-SPEC\( (\text{ificity}) \)) characterizes the contextual background of reactive queries and assertions. The rule states that if \( q \) is the maximal element of QUD, then either participant may make a \( q \)-specific move—an utterance that is a partial answer to or sub-question of \( q \). Disagreement is accommodated since asserting \( p \) makes \( p? \), the maximal element in QUD, and \( p? \)-specific utterances include disagreements. Self-answering is directly accommodated by QSPEC given that it licenses utterances specific to the maximal element in QUD regardless of who the speaker of the most recent Move is. Moreover, the accounts of querying and assertion scale up to multilogue, conversations involving more than two participants. Given A’s query \( q \), QSPEC and the ordering on QUD ensures that \( q \)-specific utterances
can be given by multiple participants as long as \( q \) remains under discussion. As far as assertion goes, the default possibility that emerges is communal acceptance—acceptance by one conversationalist can count as acceptance by all other addressees of an assertion, a possibility whose robustness is supported by corpus evidence.

Trying to operationalize genre-based relevance presupposes that we can classify conversations into various genres, a term we use following Bakhtin 1986 to denote a particular type of interactional domain (e.g. interaction at a train station, at a bakery, ‘casual chat’ etc.). There are at present remarkably few such taxonomies at present (though see Allwood 1999 for an informal one.). What one can do within KoS is to develop classifications of conversations into genres. One way is by providing a description of an information state of an agent who has successfully completed such a conversation. Final states of a conversation can be provided in terms of shared assumptions, moves, and an additional field Questions No (longer) Under Discussion (QNUD), a list of issues characteristic of the genre which will have been resolved in interaction. This, in turn, allows one to offer a characterization of the contextual background of initiating moves, moves that occur conversation initially and periodically during extended interactions. Roughly, one can make an initiating move \( m_0 \) if one believes that the current conversation updated with \( m_0 \) can be anticipated to conclude as final state \( dgb_1 \) which is a conversation of type \( G_0 \).

Probably the main innovation of KoS is the integration of illocutionary and metacommunicative interaction. This is explicated in terms of the dynamics of the locutionary proposition \( p_u \), an Austinian proposition (Barwise and Etchemendy 1987) defined by the utterance and \( T_u \), a grammatical type for classifying \( u \) that emerges during the process of parsing \( u \). In the immediate aftermath of a speech event \( u \), the DGB gets updated with \( p_u \). In case \( p_u \) is true—\( T_u \) completely classifies \( u \)—\( p_u \) becomes the LatestMove of the DGB and relevance possibilities discussed in the previous paragraph come into operation. The other contextual branch involves clarification interaction. The coherence of clarification requests such as (13c) can be specified by means of a uniform class of conversational rules, dubbed Clarification Context Update Rules (CCURs) in Ginzburg 2010. Each CCUR specifies a question that gets accommodated as the maximal element of QUD built up from a sub-utterance \( u_1 \) of the target utterance and from its corresponding utterance type (e.g. ‘What did speaker mean by \( u_1 \’)’. Common to all CCURs is a license to make an utterance which is co-propositional with the maximal
element of QUD. CoPropositionality for two questions means that, modulo their domain, the questions involve similar answers.

### 3.2 Question–integrating logics

An alternative strategy for explicating the effect of questions on context in terms of operations on information states conceived in standard possible worlds terms. (Groenendijk 2006) defines the game of interrogation—a logical idealization of the process of cooperative information exchange. Groenendijk uses a simple query-language, the language from (Groenendijk and Stokhof 1997)—first order predicate logic enriched with simplex interrogatives with the corresponding partition semantics. As a means of combining the data emanating from declaratives and the partition representing the issues, a context C is taken to be a symmetric and transitive relation on the set of possible worlds W. Context change potentials can be assigned uniformly to indicatives and interrogatives, but they have different effects on context:

(14) a. An indicative $\phi!$ is **informative** iff it eliminates a pair of worlds from the context as soon as $\phi!$ is false in one of the worlds of the pair.

b. An interrogative $\phi?$ is **inquisitive** iff it eliminates a pair of worlds (or disconnects two worlds) if they belong to different alternatives, i.e., if the two worlds differ in such a way that the question would receive a different answer in them.

This set up allows notions of consistency and entailment to be defined that apply indiscriminately to propositions and questions, notions that enable the formulation of Quality and Quantity requirements for the cooperative exchange of information. The main novelty is the notion of licensing, a notion of strict relevance: a sentence $\phi$ is contextually licensed if whenever it causes a world to be eliminated from the data, it does so also to all worlds related to it. This means that $\phi$ only addresses the currently live issues. Licensing gives rise to notions of answerhood that are significantly more inclusive than given by partitions. For instance, non-exhaustified quantified propositions (e.g., $\exists x P x$ and $\forall x P x$) are licensed as answers to $\forall x P x$. Groenendijk shows how to apply these notions in ambiguity resolution based on the assumption that an interpretation is chosen in such a way that the emergent a discourse is pertinent—a notion that encapsulates consistency, non-redundancy, and licensing. For a related approach see (Dekker 2006) who, on the basis of a
synthesis of dynamic semantics, Gricean pragmatics, and relevance theory, shows how to characterize the optimality of a discourse.

This general strategy is taken a step further in *Inquisitive Semantics* (Groenendijk 2009; Groenendijk and Roelofsen 2009). Syntactically no distinction is made between declaratives and interrogatives—standard propositional logic syntax is employed. Sentences are associated with sets of alternative possibilities. Sentences are *informative* if they contain at least one possibility and also exclude at least one possibility. Sentences are *inquisitive* if they contain at least two possibilities. The semantics is set up in particular to ensure that sentences of the form $\neg \phi$ are not inquisitive, whereas sentences of the form $\phi \lor \psi$ typically are. Thus, the polar question $p ?$ is identified with the disjunction $p \lor \neg p$. In this approach a single uniform interpretation of implication is provided that deals both with conditional questions and conditional assertions. Moreover, problems that beset Hamblin picture accounts concerning the distinction between alternative and polar questions (see the earlier discussion of structured meanings) can be resolved straightforwardly.

A related approach, cast within (an extension of) Dynamic Epistemic Logic, has been developed by van Benthem and Minică (van Benthem and Minica 2009). They develop a logic which makes explicit the asking of questions—allowing one to track the dynamics of issues as they get introduced and are potentially resolved. Two particularly interesting features of this approach are (a) it enables the modelling of multi-agent scenarios, and (b) its development of *temporal protocols* that allow one to encode constraints on allowable sequences of interrogations (cf. our earlier discussion of *genres*).

A number of works have refined the partition theory to enable it to accommodate the agent-relative context dependence that has been argued to affect exhaustiveness. (Aloni 2005) achieves this by defining partitions using individual concepts rather than rigidly designating variables. (van Rooy 2003) links up semantic theory with decision theory (following the lead of (Parikh 1992) in developing an account of why queries arise. Van Rooij adopts the assumption that it is context dependent whether a proposition completely answers a question or not. He maintains the strategy that a question is to be identified with its set of resolving answers, but assumes that the interpretation of a wh-interrogative is underspecified by its conventional meaning. Crucially, he offers a very explicit proposal as to how the underspecification is to be resolved—proposing that it be viewed as a *decision problem* in the sense of Decision Theory (e.g. (Savage 1954)). Decision problems are conceived of via the notion of the *expected utility of an action* $a$. This allows the
characterization of various key notions:

- **The utility of proposition C, UV(C):** calculated as the difference between the expected utility of the action which has maximal expected utility in case one may choose *after* one learns that C is true, and correspondingly *before* one learns that C is true.

- **The expected utility of a question:** calculated as the average expected utility of the answer that will be given.

- **Information C resolves a decision problem:** if after learning C, one of the actions dominates all other actions, i.e., if in each resulting world no action has a higher utility than this one.

Using decision theoretic notions allows one also to formulate a solution to problems such as the required exhaustiveness of an answer and determining the domain of quantification of a question. This is done by maximizing the relevance of a question—the expected utility value of the resulting question, i.e., partition, should be as high as possible. This has the result that all individuals that could be relevant for the agent’s decision should be in the domain.

### 3.3 Questions in SDRT

In a series of works (Asher and Lascarides 1998; Asher and Lascarides 2003) scale up Segmented Discourse Representation Theory (SDRT), a theory originally intended to explicate the coherence of text to provide a theory of coherence of questions in dialogue. Agents construct a discourse structure (an *SDRS*) incrementally, as a conversation unfolds. Asher and Lascarides argue that two logics are involved in NL inference: a decidable *glue logic* for constructing SDRSs and a rich logic of information content. *Rhetorical relations* link pairs of speech acts—each relation corresponds to a speech act type with the second relatum the appropriate background context. For instance, various answer-classifying relations relates a proposition with a prior query. This extends speech act theory (see discussion in (Groenendijk and Stokhof 1997, pp. 1064–1073) intersententially. Rhetorical relations are posited only if they have concrete context change potential effects, for instance imposing constraints on antecedents on anaphora. The current utterance is coherent for a given agent if the agent can compute a rhetorical relation that
connects it to her SDRS and also a a rhetorical relation intended by the speaker. In this framework a detailed theory of query/response coherence, able to deduce various implicatures, is developed, by formulating axioms that explicate various rhetorical relations. These range from an essentially semantic QuestionAnswerPair (QAP) that relates a true direct answer to a query, through IndirectQuestionAnswerPair (IQAP) that relates a proposition that entails a true direct answer relative to an agent’s SDRS, to (Not Enough Information) NEI, which characterizes pragmatically unsatisfactory responses. By making reference to agents’ plans, a precise and detailed characterization of query responses exemplified by (15a) can be provided. This is based on the axiom on the rhetorical relation Q(query)-Elab(oration) informally summarized in (15b):

(15)  a. A: When shall we meet? B: Are you free on the 18th?

  b. If Q-Elab(α, β) holds between an utterance α uttered by A, where g is a goal associated by convention with utterances of the type α, and the question β uttered by B, then any answer to β must elaborate a plan to achieve g

4 Other question related work

There has been much additional work on question–related issues over the last decade. This includes:

- Work on the knowing that v. knowing how distinction: the paper (Stanley and Williamson 2001) stimulated many reactions collected in (Bengson and Moffett 2010).

- Negative Polarity Items in questions: (Van Rooy 2003; Guerzoni and Sharvit 2007).

- Echo/Reprise questions: (Noh 1998; Ginzburg and Sag 2000)


- Predicates that select for interrogatives: (Ginzburg and Sag 2000; Lahiri 2002; Beck and Sharvit 2002)—the latter two references address the quantificational variability effect.

- polar questions: (Romero and Han 2004; Asher and Reese 2005)
5 Conclusions

As this brief survey has indicated, there is still vigorous discussion concerning the issue of what questions are and how best to characterize them. Nonetheless, there seems to be an emerging consensus about the need for adopting a dialogical perspective within which such characterization should take place. This entails the need to provide a detailed account of the response space of a query, though the empirical range of this is still far from generally agreed. Queries provided as responses are an area on which there is much emerging and distinctive research, from all types of frameworks surveyed here.

Another area where there has been renewed engagement and progress concerns Boolean operations on questions and propositions, including mixed cases. Detailed empirical work is still needed in combination with formal accounts, as the new possibilities that have emerged also lead to overgeneration unless suitable constrained.

As common in semantics, the tension between achieving empirical v. cognitive v. logical adequacy is continually apparent. The extent to which all three can be combined remains an open question one hopes will be resolved positively.

References

Asher, N. and Reese, B.: 2005, Negative bias in polar questions, in Proceedings of SuB9, pp 30–43
Bakhtin, M.: 1986, Speech Genres and Other Late Essays, University of Texas Press

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CSLI Publications, Stanford: California


van Benthem, J. and Minica, S.: 2009, Toward a dynamic logic of questions, in X. He, J. Hory, and E. Pacuit (eds.), *Proceedings of Logic, Rationality