Questions and Internalizing Relevance

Jonathan Ginzburg

1 Introduction

One of the most influential theories of questions, the theory of Hamblin [Hamblin(1973)] seems to have emerged as a consequence of Hamblin's earlier work on conversational relevance in the dialogue games of scholastic logic [Hamblin(1970)]. Hamblin can be understood as proposing his interrogative denotations as a means for operationalizing relevance:

(1) (H) p is relevant as a response to q if $p \in q$.

In what follows, I restrict attention to relevance (in the sense of *conversational coherence*) relating a query to a possible (felicitous) response.[1] The interrogative denotations Hamblin proposed seem to provide sufficient conditions for relevance. But they fall far short of providing necessary conditions.

(2) Carla: Are you voting for Tory?
(a) Denise: I might.
(b) Denise: Tory?
(c) Denise: I don't know.
(d) Denise: What voting system is in use?

(3) Rhiannon: How much tape have you used up?
(a) Chris: About half of one side.
(b) Chris: Not much.
(c) Chris: What do you mean "used up"?

Some of the cases which fall outwith Hamblin's characterization point,[2] as I have argued previously [Ginzburg(1995)], to a deficiency in his semantic treatment

[1] A more general theory is presented in my forthcoming monograph [Ginzburg(2010a)].

[2] Hamblin's work, an early instance of a dynamic conception of meaning, includes formal descriptions of a number of distinct dialogue games which provide options for providing responses that are not "answers", for instance a no–commitment (e.g. 'I don't know') response to a query.

of interrogatives (e.g. ((2)a) and ((3)a,b)); similar criticisms can be posed towards other, more recent theories of interrogatives, as I will note below. But the other cases suggest that, while a theory of interrogatives has a role to play in characterizing relevance, it cannot do the job on its own. Studying the notion of relevance, in a limited sense akin to (H) or in a wider sense, does not seem to require justification—it is a fundamental component of a theory of conversational interaction. And yet both the narrower and wider sense of relevance, difficult as they are to characterize, have been strangely neglected in linguistic work on interrogatives in recent years.[3]

Beyond this, one issue to consider is whether there really is a need for a single notion of relevance—whose restriction to query moves we discuss here, internalized in some way within the theory of meaning.[4] There is at least one substantive argument for internalizing relevance, as well as some methodological motivation. The substantive argument is that a unitary notion of conversational relevance seems to underpin certain types of clarification questions—ones that arise when the coherence of an utterance seems unclear, as in ((4)a). Similarly, as Grice famously pointed out, *lack of conversational relevance* seems to underpin the inference that one does not wish to address a prior utterance, as in ((4)b):

(4) a. Marjorie: Don't touch that cos she hasn't had it yet. Dorothy: Does she eat anything? Marjorie: What do you mean? (British National Corpus (BNC))

b. Dr. Grimesby Roylott: My stepdaughter has been here. I have traced her. What has she been saying to you?
Sherlock Holmes: It is a little cold for the time of the year.
Dr. Grimesby Roylott: What has she been saying to you?
Sherlock Holmes: But I have heard that the crocuses promise well. ('The Speckled Band', Sir Arthur Conan Doyle, *The Adventures of Sherlock Holmes*, John Murray, London.)

The methodological argument is that characterizing relevance pushes theories of interrogatives to be concrete, forcing them to be precise about the range of propositions they characterize as answers and to offer sources of relevance to utterances whose relevance as an answer they do not underpin. It also enables one

[3]The most notable exception to this is the account developed by Nicholas Asher and Alex Lascarides in [Asher & Lascarides(2003)]. Qualitatively the most important difference is that Asher and Lascarides do not develop a theory of metacommunicative interaction. A more detailed comparison between their account and the one presented here will be provided in a later version of this paper.

[4]I use 'theory of meaning' to avoid boring territorial disputes between semantics and pragmatics. I attempt, nonetheless, to be reaosnably explicit as to whether components of the theory of relevance refer to public context or to agent–internal parameters, which is essentially how I view the distinction.

to operationalize the notion of relevance for use in corpus studies and for other computational work.

In this paper I sketch an account of relevance within the dialogue theory KoS [Ginzburg(1994), Ginzburg & Cooper(2004), Larsson(2002), Purver(2006), Fernández(2006), Ginzburg(2010a), Ginzburg & Fernández(2010)]. The basic intuition is that relevance of an utterance relative to an agent's information state amounts to the possibility of integrating the utterance into the information state. As we will see, 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 I employ Type Theory with Records (TTR) (Cooper, 2005). KoS and TTR are introduced in section 2. I start by discussing relevance that is derived directly from interrogative semantics, what I will term q(uestion)-specificity—this includes both answerhood and the relation of dependence between questions. I then consider metacommunicative relevance—this is a notion that holds between an utterance and propositions and questions, respectively, that acknowledge the utterance as understandable or seek clarification about the utterance. Metacommunicative relevance makes us realize that relevance is, in general, a notion that cannot be defined in purely semantic terms (i.e. at the level of content), but requires us to bring utterances—speech events into the picture. I will also consider briefly two more types of relevance, metadiscursive relevance (a notion that underwrites utterances like "I don't know" and 'I don't want to talk about this.") and genre-based relevance, the latter much studied in AI work on dialogue. Finally, I will try to combine the various notions of relevance so that they can be used to explicate examples of the type (4) above. I also provide results of a pilot corpus study that shows that this notion of relevance achieves high rates of success in classifying responses to queries.

2 KoS and TTR

2.1 Type Theory with Records: the basics

As the underlying logical framework, I use Type Theory with Records (TTR) [Cooper(2005)], a model–theoretic descendant of Martin-Löf Type Theory [Ranta(1994)]. What is crucial for current purposes about this formalism, which takes situation semantics as one of its inspirations, is that it provides access to both types and tokens at the object level. Concretely, this enables simultaneous reference to both utterances and utterance types, a key desideratum for modelling metacommunicative interaction. This distinguishes TTR from (standard) Discourse Representation

Theory,[5] for instance, where the witnesses are at a model theoretic level, distinct from the level of discourse representations. The provision of entities at both levels of tokens and types allows one to combine aspects of the typed feature structures world and the set theoretic world, enabling its use as a computational grammatical formalism. The formalism can, consequently, be used to build a semantic ontology, and to write conversational interaction and grammar rules.

The most fundamental notion of TTR is the typing *judgement* $a : T$ classifying an object a as being of type T. A record is an partially ordered set of the form (5)—each assignment to a field constituting a component of the tuple. Crucially, each successive field can depend on the values of the preceding fields:

(5) a. $\begin{bmatrix} l_i = k_i \\ l_{i+1} = k_{i+1} \ldots \\ l_{i+j} = k_{i+j} \end{bmatrix}$

b. $\begin{bmatrix} \text{x = a} \\ \text{y = b} \\ \text{prf = p} \end{bmatrix}$

A record type is simply a partially ordered set of fields of the form ((6)), where again each successive type can depend on its predecessor types within the record:

(6) $\begin{bmatrix} l_i : T_i \\ l_{i+1} : T_{i+1} \ldots \\ l_{i+j} : T_{i+j} \end{bmatrix}$

[Cooper(2005)] proposes that situations and events be modelled as records. Situation and event types are then directly accommodated as record types. The type of a situation with a woman riding a bicycle would then be the one in (7a). A record of this type (a *witness* for this type) would be as in (7b), where the required corresponding typing judgements are given in (7c):

[5]There are versions of DRT that do allow for the presence of witnesses in the logical representation, e.g. Compositional DRT [Muskens(1996)], employed to underpin the PTT dialogue framework [Poesio & Rieser(2009)].

(7) (a) $\begin{bmatrix} \text{x: IND} \\ \text{c1: woman(x)} \\ \text{y: IND} \\ \text{c2: bicycle(y)} \\ \text{time : TIME} \\ \text{loc:LOC} \\ \text{c3: ride(x,y,time,loc)} \\ \end{bmatrix}$ (b) $\begin{bmatrix} \dots \\ \text{x = a} \\ \text{c1 = p1} \\ \text{y = b} \\ \text{c2 = p2} \\ \text{time = t0} \\ \text{loc = l0} \\ \text{c3 = p3} \\ \dots \end{bmatrix}$

(c) a : IND; p1 : woman(a); b : IND; p2 : bicycle(b); t0 : TIME; l0 : LOC;p3 : ride(a,b,t0,l0);

In TTR utterance events, like other events, are a kind of record, whereas lexical entries and phrasal rules are explicated as record types. One could, for instance, posit the sound/syntax/meaning constraint in ((8)a) as a rule of English. For a speech event $se0$, ((8)b), to be classified as being of this type, the requirements in ((8)c) will need to be met:[6]

(8) a. $\begin{bmatrix} \text{PHON : who did jo leave} \\ \text{CAT = V[+fin] : syncat} \\ \text{C-PARAMS : } \begin{bmatrix} \text{s0: SIT} \\ \text{t0: TIME} \\ \text{j: IND} \\ \text{c3: Named(j,jo)} \end{bmatrix} \\ \text{cont = (r : } \begin{bmatrix} \text{x : Ind} \\ \text{rest : person(x)} \end{bmatrix}) \begin{bmatrix} \text{sit = s0} \\ \text{sit-type = Leave(j,r.x,t0)} \end{bmatrix} \text{: Questn} \end{bmatrix}$

[6] A convention we employ here to distinguish phonological tokens and types is to refer to the latter with English words and the former with a mock representation of their pronunciation.

b. $\begin{bmatrix} \text{PHON} = \text{di jo liv} \\ \text{CAT} = \text{V[+fin]} \\ \text{C-PARAMS} = \begin{bmatrix} \text{s0} = \text{sit0} \\ \text{t0} = \text{time0} \\ \text{j} = \text{j0} \\ \text{c3} = \text{c30} \end{bmatrix} \\ \text{cont} = (\text{r} : \begin{bmatrix} \text{x} : \text{Ind} \\ \text{rest} : \text{person(x)} \end{bmatrix})\begin{bmatrix} \text{sit} = \text{s0} \\ \text{sit-type} = \text{Leave(j,r.x,t0)} \end{bmatrix} \end{bmatrix}$

c. hu di jow liv : `who did jo leave`;
sit0 : SIT, time0 : TIME, j0 : IND, c30 : Named(j0,jo)
cont0 = $(\text{r} : \begin{bmatrix} \text{x} : \text{Ind} \\ \text{rest} : \text{person(x)} \end{bmatrix})\begin{bmatrix} \text{sit} = \text{sit0} \\ \text{sit-type} = \text{Leave(j0,time0)} \end{bmatrix}$: Questn

Specifically: a witness for the type ((8)a) includes a phonetic token, contextual parameters—a situation, a time, an individual named Jo—and the question entity $(\text{r} : \begin{bmatrix} \text{x} : \text{Ind} \\ \text{rest} : \text{person(x)} \end{bmatrix})\begin{bmatrix} \text{sit} = \text{sit0} \\ \text{sit-type} = \text{Leave(j0,r.x,time0)} \end{bmatrix}$, a function from records into propositions.

TTR offers a straightforward way for us to model propositions and questions using records, record types, and functions. I follows here the austinian approach to propositions, first proposed by [Barwise & Etchemendy(1987)], in which a proposition is an abstract entity individuated in terms of a situation and a situation type. There are a number of semantic motivations for this, pros and cons of which are discussed in [Ginzburg(2010b)]. For current purposes, this approach plays an important role in characterizing metacommunicative relevance, as explained in section 4. A proposition is a record of the form in ((9)a). The type of propositions is the record type ((9)b) and truth can be defined as in ((9)c):

(9) a. $\begin{bmatrix} \text{sit} = r_0 \\ \text{sit-type} = T_0 \end{bmatrix}$

b. $\begin{bmatrix} \text{sit} : \text{Record} \\ \text{sit-type} : \text{RecType} \end{bmatrix}$

c. A proposition $\begin{bmatrix} \text{sit} = r_0 \\ \text{sit-type} = T_0 \end{bmatrix}$ is true iff $r_0 : T_0$

A question can be identified as a propositional abstract. Extensive motivation for this view is provided in [Ginzburg & Sag(2000)]. For current purposes, the main motivation for adopting this view is, as we will see below, that it enables one to characterize a wide range of answerhood relations. In TTR, being a propositional abstract amounts to being a function from records into propositions:

(10) a. Did Bo run

TTR representation—$(\text{r} : \left[\ \right]) \left[\begin{array}{lcl} \text{sit} & = & r_1 \\ \text{sit-type} & = & \left[\text{c} : \text{run(b)}\right] \end{array}\right]$. That is, a function that maps records $\text{r} : \text{T}_0 = \left[\ \right]$ into propositions of the form $\left[\begin{array}{lcl} \text{sit} & = & r_1 \\ \text{sit-type} & = & \left[\text{c} : \text{run(b)}\right] \end{array}\right]$

b. who ran

c. TTR representation—$(\text{r} : \begin{bmatrix}\text{x} : \text{Ind} \\ \text{rest} : \text{person(x)}\end{bmatrix}) \begin{bmatrix}\text{sit} = r_1 \\ \text{sit-type} = \left[\text{c} : \text{run(r.x)}\right]\end{bmatrix}$

That is, a function that maps records $\text{r} : \text{T}_{who} = \begin{bmatrix}\text{x} : \text{Ind} \\ \text{rest} : \text{person(x)}\end{bmatrix}$ into propositions of the form $\begin{bmatrix}\text{sit} = r_1 \\ \text{sit-type} = \left[\text{c} : \text{run(r.x)}\right]\end{bmatrix}$

2.2 Information States

On the view developed in KoS, there is actually no single context, for reasons connected primarily with the integration of metacommunicative and illocutionary interaction, which I will touch on in section 4. Instead of a single context, analysis is formulated at a level of information states, one per conversational participant. The type of such information states is given in (11a). I leave the structure of the private part unanalyzed here, for details on this, see [Larsson(2002)]. The dialogue gameboard represents information that arises from publicized interactions. Its structure is given in the type specified in (11b):

(11) a. TotalInformationState (TIS):

$\begin{bmatrix}\text{dialoguegameboard} : \text{DGB} \\ \text{private} : \text{Private}\end{bmatrix}$

b. DGB =

$$\begin{bmatrix} \text{spkr: Ind} \\ \text{addr: Ind} \\ \text{c-utt : addressing(spkr,addr)} \\ \text{Facts : set(Proposition)} \\ \text{Pending : list(locutionary Proposition)} \\ \text{Moves : list(locutionary Proposition)} \\ \text{QUD : poset(Question)} \end{bmatrix}$$

In this view of context:

- The spkr/hearer roles serve to keep track of turn ownership.
- **FACTS** represents the shared knowledge conversationalists utilize during a conversation. More operationally, this amounts to information that a conversationalist can use embedded under presuppositional operators.
- **Pending**: represents information about utterances that are as yet ungrounded. Each element of Pending is a *locutionary proposition*, a proposition individuated by an utterance event and a grammatical type that classifies that event. The motivation for this crucial modelling decision, which concerns the input to grounding and CRification processes and which carries on to the Moves repository, is discussed in section 4.
- **Moves**: represents information about utterances that have been grounded. The main motivation is to segregate from the entire repository of presuppositions information on the basis of which coherent reactions to the latest conversational move can be computed. For various purposes (e.g. characterizing the preparatory conditions of moves such as greeting and parting) it is actually important to keep track of the entire repository of moves.
- **QUD**: (mnemonic for Questions Under Discussion)—questions that constitute a "live issue". That is, questions that have been *introduced for discussion* at a given point in the conversation and not yet been *downdated*. The role of questions in structuring context has been recognized in a variety of works, including [Hamblin(1970), Carlson(1983), Van Kuppevelt(1995)], [Ginzburg(1994), Ginzburg(1996a), Roberts(1996), Larsson(2002)]. There are additional ways for questions to get added into QUD, the most prominent of which is during metacommunicative interaction, as we will see shortly. Being maximal in QUD (MAX-QUD) corresponds to being the current 'discourse topic' and is a key component in the theory.

The Dialogue GameBoard, then, constitutes the publicized context in KoS—taking into account that conversationalists' DGBs need not be identical throughout. Work in KoS (e.g. [Fernández & Ginzburg(2002), Fernández(2006), Ginzburg(2010a)]) has shown that virtually all types of non-sentential utterance, ranging from short answers, propositional lexemes (e.g. 'yes', 'no'), through reprise fragments, can be analyzed as *indexical* expressions relative to the DGB.

Context change is specified in terms of *conversational rules*, rules that specify the *effects* applicable to a DGB that satisfies certain *preconditions*. As we will see, this allows both illocutionary effects to be modelled (preconditions for and effects of greeting, querying, assertion, parting etc), interleaved with *locutionary effects*. How querying works in this framework I will illustrate in the next section, once we have discussed *q(uestion)–specificity*.

3 Question–Specificity

3.1 Aboutness

What response is appropriate or possible for a given query depends on a variety of factors, including domain knowledge, the interlocuters' goals, politeness etc. Nonetheless, there is also a not inconsiderable role for semantics: any speaker of a given language can recognize, independently of domain knowledge and of the goals underlying an interaction, that certain propositions are *about* or *directly concern* a given question. This, I suggest, is the answerhood relation needed for characterizing interrogative relevance

How can this notion of answerhood be characterized? Hamblin's notion of answerhood is one of the simplest notion of answerhood we can define on the basis of an abstract. I will refer to it as *hamblin answerhood*.

(12) a. p is a hamblin answer to q iff p is an instantiation of q or a negation of such an instantiation.

b. For a polar question: $\{r \mid HamblinAns(r, \lambda\{\ \}p)\}$ = $\{p, \neg p\}$

c. For a unary *wh*-question: $\{r \mid HamblinAns(r, \lambda\{b\}p(b))\}$ = $\{p(a_1), \ldots, p(a_n), \neg p(a_1), \ldots, \neg p(a_n)\}$

Hamblin answerhood covers a fair amount of ground. But it clearly underdetermines aboutness. On the polar front, it leaves out the whole gamut of answers to polar questions that are weaker than p or $\neg p$ such as conditional answers 'If r, then p' (e.g. (13)a) or weakly modalized answers 'probably/possibly/maybe/possibly not p'(e.g. (13)b). As far as wh-questions go, it leaves out quantificational answers

((13)c-g), as well as disjunctive answers. These missing class of propositions, are pervasive in actual linguistic use:

(13) a. Christopher: Can I have some ice-cream then?
Dorothy: you can do if there is any. (BNC)

b. Anon: Are you voting for Tory?
Denise: I might. (BNC, slightly modified)

c. Dorothy: What did grandma have to catch?
Christopher: A bus. (BNC, slightly modified)

d. Rhiannon: How much tape have you used up?
Chris: About half of one side. (BNC)

e. Dorothy: What do you want on this?
Andrew: I would like some yogurt please. (BNC, slightly modified)

f. Elinor: Where are you going to hide it?
Tim: Somewhere you can't have it.(BNC)

g. Christopher: Where is the box?
Dorothy: Near the window. (BNC)

The simplest way to enrich Hamblin answerhood is by closing hamblin answerhood under disjunction.[7] One way to implement this is to offer the following as a definition of aboutness:

(14) p is about q iff p entails a (finite) disjunction of hamblin answers.

Due to the fact that for a given question the class of hamblin answers always contains at least one proposition p and its negation $\neg p$, the definition is (22) is restrictive only within a logical framework in which the law of the excluded middle fails. That is, a setting in which ((15)) is the case:

(15) $p \vee \neg p$ is not vacuously true.

This is one motivation to use as logical underpinning for this work constructive frameworks in which indeed ((15)) is maintained. Within one such framework, situation theory, [Ginzburg(1995), Ginzburg & Sag(2000)] show that aboutness as defined in (22) seems to encompass the various classes of propositions exemplified in (13). Thus:

[7] Such a notion was proposed in [Groenendijk & Stokhof(1984)]. One problem for this notion within the context of a partition theory of questions is that it yields no new answers for polar questions. Another problem is that for wh–questions it yields only exhaustified answers.

- By defining $possibly(p)$ as involving (a) the truth of $p \vee r$, where p, r are incompatible and (b) $\neg p$ not being proven, one can show $possibly(p)$ is about $p?$. By monotonicity, all modalities stronger than 'possibly' are also about $p?$.

- Existence-entailing generalized quantifiers such as existentials satisfy aboutness by virtue of their entailing the truth of a positive instantiation of a given wh-question.

- Generalized quantifiers such as 'At most one N' or 'Few N' satisfy aboutness by virtue of their entailing the truth of a positive or negative instantiation of a given wh-question.[8]

3.2 Dependence and Influence

So far we have discussed answerhood, a relation between propositions and questions, which plays an important role in regulating which responses which can be provided to queries. Any inspection of corpora, nonetheless, reveals the underdiscussed fact that many queries are responded to with a query. A large proportion of these are clarification requests, to be discussed in section 4, as exemplified in ((16)):

(16) a. Anon 1: Did, did, did, did they have the union in there at all or (pause)?
Anon 2: Have what dear? (BNC, K62)

b. Anon 2: Should there be er a change in the rules?
Anon 3: What rules?

But in addition to these, there are query responses whose content directly addresses the question posed, as exemplified in ((17)):

(17) a. A: Who murdered Smith? B: Who was in town?

b. A: Who is going to win the race? B: Who is going to participate?

c. Carol: Right, what do you want for your dinner?
Chris: What do you (pause) suggest? (BNC, KbJ)

[8]Note that in frameworks like Situation Theory or Constructive Type Theory, a proposition such as 'At most one student left' can be made to entail—within a suitable extension to cover generalized quantifiers, for some individual 'Kim', the truth of either 'Kim left' or 'Kim did not leave'. But it will not entail, for instance, the truth of either 'Kim is tall' or 'Kim is not tall'.

d. Chris: Where's mummy?
Emma: Mm?
Chris: Mummy?
Emma: What do you want her for? (BNC, KbJ)

One natural hypothesis about such query responses, first articulated by [Carlson(1983)], is that they are constrained by the semantic relations of *dependence*, or its converse *influence*. In other words, these relations constitute the corresponding 'aboutness' for question responses. A straightforward definition of these notions is in ((18)b). Its intuitive rationale is this: discussion of q_2 will necessarily bring about the provision of information about q_1:[9]

(18) a. q_2 can be used to respond to q_1 if q_2 influences q_1 (q_1 depends on q_2)

b. q_2 influences q_1 iff any proposition p such that p Resolves q_2, also satisfies p entails r such that r is About q_1.

This characterization works well for cases such as (17a-c):

(19) a. Who killed Smith depends on who was in town at the time.

b. What Chris wants for dinner depends on what Carol will suggest.

Question dependence seems to constitute a sufficient condition for felicity of a (non-metacommunicative question) response. It does not seem to be a necessary condition. For instance, (17d) is felicitous but does not permit the inference

(20) Where Mummy is depends on what Chris wants for her.

This supports the proposal of [Larsson(2002)] that the requisite question/question relation needs to be pragmatically relativized. I return to this issue below.

3.3 Answerhood in TTR

We first define an auxiliary notion of *atomic answerhood*, specified in terms of the (family of) record type(s) in ((21)a). There the label *shortans* is a field for an entity of type the domain of the question,[10] the label *compoundans* is a field

[9]The definition of influence/dependence in ((18)b) makes reference to the answerhood notion of resolvedness, an agent–relative notion of exhaustiveness, as argued in [Ginzburg(1995)]. ALthough for the moment I don't spell this out, this makes influence/dependence agent–relative rather than purely semantic notions, in contrast to aboutness. One could eliminate this asymmetry by using a purely semantic notion of exhaustiveness. This issue is further discussed below.

[10]This is of course a mnemonic to the fact that short answers involve a term of this type.

for an instantiation of q, whereas the label *propans* is a field for a proposition that constitutes an atomic answer, which is a conjunct of *compoundans*;[11] ((21)b) is then straightforward:

(21) Given a question $q : (A \rightarrow Prop)$:

a. AtomAns(q) $=_{def}$ $\begin{bmatrix} \text{shortans} : \text{A} \\ \text{atans} = \text{q(shortans)} : \text{Prop} \end{bmatrix}$

b. HamblinAns(q) $=_{def}$ $\begin{bmatrix} \text{at} : \text{AtomAns(q)} \\ \text{hamblinans} = at.propans \vee \neg at.propans : \text{Prop} \end{bmatrix}$

Hamblin answerhood covers a fair amount of ground. Thus, given that a polar question is a 0-ary abstract ([])p, its instantiations amount to the singleton $\{p\}$. Hence the hamblin answers of ([])p are p and $\neg p$. By the same token, the instantiations of a unary wh-question ([x:A])q(x) are all the propositions of the form $q(a)$ and $\neg q(a)$, where $a : A$.

As we discussed earlier, Hamblin answerhood clearly underdetermines aboutness. As we suggested above, a simple way to enrich hamblin answerhood is by closing hamblin answerhood under disjunction:

(22) p is about q iff p entails a (finite) disjunction of hamblin answers.

We can capture this in terms of the family of record types in ((23)); here *simpans* is a field for a list of hamblin answers, *disjans* is a field for their disjunction,[12] and *propans* is a proposition that entails this disjunction:

(23) Given a question $q : (A \rightarrow Prop)$:

a. Aboutness(q) $=_{def}$ $\begin{bmatrix} \text{simpanslist} : \left[\text{HamblinAns(q)}\right] \\ \text{disjans} = \bigvee_{hamblinans} \text{simpanslist} : \text{Prop} \\ \text{propans} : \text{Prop} \\ \text{c} : \rightarrow\text{(propans,disjans)} \end{bmatrix}$

[11] A slightly more complicated definition is needed if one wishes to accommodate conjoined questions see [Ginzburg & Sag(2000), Ginzburg(2010a)].

[12] This definition assumes the existence of a function that maps a list of records of type HamblinAns(q) to the disjunction of the *hamblinans* fields of these records.

3.4 Questions in context

The basic notion of relevance that has emerged so far can be summarized in term of the notion of q-specificity in ((24)):

(24) q-specific utterance: an utterance whose content is either a proposition p About q or a question q_1 on which q Depends

This can be embedded in 2-person interaction via a protocol as in ((25)):

(25)

querying	assertion
LatestMove = Ask(A,q)	LatestMove = Assert(A,p)
A: push q onto QUD; release turn;	A: push p? onto QUD; release turn
B: push q onto QUD; take turn; make q—specific utterance take turn.	B: push p? onto QUD; take turn; Option 1: Discuss p? Option 2: Accept p
	LatestMove = Accept(B,p)
	B: increment FACTS with p; pop p? from QUD;
	A: increment FACTS with p; pop p? from QUD;

As argued in [Ginzburg(2010a)], the only query specific aspect of the query protocol in (25) is the need to increment QUD with q as a consequence of q being posed:

(26) Ask QUD–incrementation:

$$\begin{bmatrix} \text{pre} : \begin{bmatrix} \text{q} : \text{Question} \\ \text{LatestMove} = \text{Ask(spkr,addr,q):IllocProp} \end{bmatrix} \\ \text{effects} : \left[\text{qud} = [\text{q,pre.qud}] : \text{list(Question)}\right] \end{bmatrix}$$

The specification `make q-specific utterance` is an instance of a general constraint that characterizes the contextual background of reactive queries and assertions. This specification can be formulated as in ((27)): the rule states that if q is QUD–maximal, then either participant may make a q–specific move. Whereas

the preconditions simply state that q is QUD–maximal, the preconditions underspecify who has the turn and require that the latest move—the first element on the MOVES list—stand in the *Qspecific* relation to q:[13]

(27) QSpec

$$\left[\begin{array}{ll} \text{preconds} & : \left[\text{qud} = \left\langle \text{q, Q} \right\rangle : \text{poset(Question)}\right] \\ \text{effects} & : \left[\begin{array}{l} \text{spkr : Ind} \\ \text{c1 : spkr = preconds.spkr} \vee \text{preconds.addr} \\ \text{addr : Ind} \\ \text{c2: member(addr,}\left\{\text{preconds.spkr,preconds.addr}\right\}\text{)} \\ \wedge\ \text{addr} \neq \text{spkr} \\ \text{r : AbSemObj} \\ \text{R: IllocRel} \\ \text{Moves} = \left\langle \text{R(spkr,addr,r)} \right\rangle \oplus m : \text{list(IllocProp)} \\ \text{c1 : Qspecific(r,preconds.qud.q)} \end{array}\right] \end{array}\right]$$

The notion of q–specificity still needs some refinements if it is to do its job of regulating responses that address a given question. The most direct refinement concerns *indirect answerhood*: responses that provide an answer indirectly should clearly be accommodated [Asher & Lascarides(1998)]. This means relativizing aboutness by an entailment notion based on common ground information represented in FACTS. More needs to be said about query responses, but that is probably most appropriately discussed under the notion of genre-based relevance, to which I return in section 5.2.

4 Metacommunicative Relevance

Relevance cannot be characterized in purely content–oriented terms. In other words assessing which utterances are relevant as responses to an initial query—or any other type of move for that matter—requires reference to more than the query's content. This is demonstrated most clearly by metacommunicative responses, the two main types being acknowledgements of understanding and clarification requests (CRs).

[13] This underspecification of turn ownership is the basis for a unified account of question posing in monologue, 2-person querying, and multilogue provided in [Ginzburg(2010a)].

An addressee can acknowledge a speaker's utterance, either once the utterance is completed, as in ((28)a,b), or concurrently with the utterance as in ((28)c). For conversations where the participants are visible to each other, gesture (head nodding, eye contact etc.) also provides an option by means of which affirmative moves can be made (see [Nakano *et al.*(2003)Nakano, Reinstein, Stocky, & Cassell].).

(28) a. Tommy: So Dalmally I should safely say was my first schooling. Even though I was about eight and a half. Anon 1: Mm. Now your father was the the stocker at Tormore is that right ? (BNC, K7D)

b. Wizard: Then you want to go north on Speer Boulevard for one and one half miles to Alcott Street.
User: Okay. I want to go right on Speer? (VNS Corpus, [Novick & Sutton(1994)])

c. A: Move the train ...
B: Aha
A:... from Avon ...
B: Right
A:... to Danville. (Adapted from the Trains corpus)

[Schegloff(1987)] points out that in principle one can request clarification concerning just about anything in a previous utterance. However, corpus studies of CRs in both a general corpus [Purver *et al.*(2001)Purver, Ginzburg, & Healey], as well as task oriented ones [Rodriguez & Schlangen(2004), Rieser & Moore(2005)] indicate that there are four main categories of CRs:

- **Repetition**: CRs that request the previous utterance to be repeated:

(29) a. Tim (1): Could I have one of those (unclear)?
Dorothy (2): Can you have what? (BNC, KW1)

b. s bust: Great memorial I think really isn't it?
e bust: Beg pardon?
s bust: Be a good appropriate memorial if we can afford it. (BNC, KM8)

- **Confirmation**: CRs that seek to confirm understanding of a prior utterance:

(30) a. Marsha: yeah that's it, this, she's got three rottweilers now and
Sarah: three? (=Are you saying she's got THREE rottweilers now?)
Marsha: yeah, one died so only got three now (BNC)

b. A: Is Georges here?
B: You're asking if Georges Sand is here.

- **Intended Content**: CRs that query the intended content of a prior utterance:

(31) a. Tim (5): Those pink things that af after we had our lunch.
Dorothy (6): Pink things?
Tim (7): Yeah. Er those things in that bottle.
Dorothy (8): Oh **I know what you mean.** For your throat? (BNC)

b. A: Have a laugh and joke with Dick.
B: Dick?
A: Have a laugh and joke with Dick.
B: Who's Dick?

- **Intention recognition**: CRs that query the goal underlying a prior utterance:

(32) a. X: You know what, the conference might be downtown Seattle. So I may have to call you back on that.
PT: OK. Did you want me to wait for the hotel then? (Communicator corpus)

b. Norrine: When is the barbecue, the twentieth? (pause) Something of June.
Chris: Thirtieth.
Norrine: A Sunday.
Chris: Sunday.
Norrine: Mm.
Chris: Why? (= *Why do you ask when the barbecue is*)
Norrine: Becau Because I forgot (pause) That was the day I was thinking of having a proper lunch party but I won't do it if you're going out. (BNC)

How to characterize the relevance of such responses? For reasons of space, I restrict attention to CRs. In terms of the Dialogue GameBoard the issue can be formulated as follows—what information needs to be associated with **Pending** to enable the formulation of grounding conditions/CR potential? The requisite information needs to be such that it enables the original speaker to interpret and recognize the coherence of the range of possible clarification queries that the original addressee might make.

Meanings in the Montague/Kaplan of functions from contexts, which provide values for certain parameters (the *contextual parameters*), to contents—provide a

useful notion for conceptualizing grounding/clarification potential (and were exploited for this purpose in [Ginzburg(1996b)].). This is because the range of contextual parameters offers a possible characterization of the contextually variable and hence potentially problematic constituents of utterance content. Note though that if we conceive of meanings as entities which characterize potential sources of misunderstanding, the contextual parameters will need to include all open class sub-utterances of a given utterance type (i.e. including verb, common noun, and adjective, sub-utterances). This is a far cry from the 4 place indices of Montague and Kaplan, from the meanings envisaged by [Barwise & Perry(1983)], and even from dynamicized meanings in dynamic semantics.[14]

[Ginzburg & Cooper(2004)] argue that, nonetheless, even radically context dependent meanings of this kind are not quite sufficient to characterize CR potential. One problem is the familiar one of grain. In terms of the concept or property that they represent, one would be hard pressed to distinguish the meanings of words such as *attorney* and *lawyer*. And yet, since knowledge of language is not uniform, it is clear that the clarification potential of the sentences in ((33)) is not identical. Which word was used initially makes a difference as to how the clarification can be formulated:

(33) a. Ariadne: Jo is a lawyer. Bora: A lawyer?/What do you mean a lawyer?/#What do you mean an advocate?/#What do you mean an attorney?

b. Ariadne: Jo is an advocate. Bora: #What do you mean a lawyer?/An advocate?/What do you mean an advocate?/#What do you mean an attorney?

Additional arguments for the insufficiency of meaning to characterize CR potential include:

- The syntactic and phonological parallelism exhibited by non-sentential CRs to their antecedent sub-utterance, as exemplified by ((34)a-d). Content–oriented CRs require partial syntactic parallelism: an XP used to clarify an antecedent sub-utterance u_1 must match u_1 categorially ((34)a-c). Intended content readings in fact require (segmental) phonological identity with their source, as shown in ((34)d):

(34) a. A: I phoned him. B: him? / #he?

b. A: Did he phone you? B: he? / #him?

[14]For experimental evidence about which lexical categories are viewed to be clarifiable see [Purver(2004)].

c. A: Did he adore the book. B: adore? / #adored?

d. A: Did Bo leave? B: Max? (cannot mean: intended content reading: **Who are you referring to?** or **Who do you mean?**)

- The existence of CRs whose function is to request repetition of (parts of) an utterance, see (29) above. Such CRs can, in principle, arise from any sub-utterance, as showin in ((35)a). Note that, in fact, all the CRs in ((35)) can also be construed as meaning–oriented CRs, even the function words, as further demonstrated in ((35)b):

(35) a. Who rearranged the plug behind the table?

b. Who? / rearranged?/ the plug? / behind? / the table?

c. A: Is that the shark? B: The? B: Well OK, *A*. (based on an example in the film *Jaws*.)

Consequently, the specification of CR potential requires reference to the utterance's phonological type. Indeed the fact that any sub-utterance can, in principle, give rise to clarification motivates one one relatively minor enhancement to the standard grammatical representation. Instead of keeping track solely of immediate constituents, as is handled in formalisms such as HPSG the feature DTRS, we enhance the representation itself so it keeps track of *all* constituents. This is done by positing an additional, set valued field in the type definition of signs dubbed CONSTIT(UENT)S, illustrated below in Figure 3. In [Ginzburg(2010a)], it is shown that this enhancement plays a key role in capturing cross-utterance parallelism, agreement, and scopal and anaphoric antecedency, though here I will only hint at the role it plays in formulating rules that regulate grounding and CRification.

The arguments provided hitherto point to the fact that **Pending** must incorporate the utterance *type* associated by the grammar with the clarification target. This would have independent utility since it would be the basis for an account of the various utterance presuppositions whose source can only derive from the utterance type, as in (36):

(36) a. A: Banach was born in Łodz. B: It's interesting that the last word you uttered has a sound I can't pronounce.

b. And even rain won't save you this time, Bruce, because you need to win one of the remaining matches. Sorry guys I mentioned 'win' there, you Poms might need to look that word up. (*The Guardian*, test match over by over coverage, 25 Aug 2005).

In fact, CRs typically involve *utterance anaphoricity*. In ((37)a,b) the issue is not *what do you mean by leaving* or *who is Bo* **in general**, but *what do you mean by leaving* or *who is Bo* **in this particular sub-utterance**:

(37) a. A: Max is leaving. B: leaving?

b. A: Did Bo leave? B: Who is Bo?

Taken together with the obvious need for **Pending** to include values for the contextual parameters specified by the utterance type, [Ginzburg(2010a)] argues that the type of **Pending** combines tokens of the utterance, its parts, and of the constituents of the content with the utterance type associated with the utterance. An entity that fits this specification is the *locutionary proposition* defined by the utterance: in the immediate aftermath of a speech event u, **Pending** gets updated with a record of the form $\begin{bmatrix}\text{sit} = \text{u} \\ \text{sit-type} = \text{T}_u\end{bmatrix}$ (of type *locutionary proposition* (LocProp)). Here T_u is a grammatical type for classifying u that emerges during the process of parsing u, as exemplified earlier in (8). In the most general case, given the need to accommodate structural ambiguity, it should be thought of as a *chart* [Cooper(2009)], but in the cases we consider here it can be identified with a *sign* in the sense of Head Driven Phrase Structure Grammar (HPSG). The relationship between u and T_u—describable in terms of the proposition $p_u = \begin{bmatrix}\text{sit} = \text{u} \\ \text{sit-type} = \text{T}_u\end{bmatrix}$—can be utilized in providing an analysis of grounding/CRification conditions:[15]

(38) a. Grounding: p_u is true: the utterance type fully classifies the utterance token.

b. CRification: p_u is false, either because T_u is weak (e.g. incomplete word recognition) or because u is incompletely specified (e.g. incomplete contextual resolution).

In case p_u is true, p_u becomes the LatestMove and relevance possibilities discussed in section 3.4 come into operation. I concentrate here on characterizing the range of possible CRs, specifically intended content CRs; analogous remarks apply to other types of CRs.[16] The non-sentential CRs in ((39)b-f) are all interpretable

[15] A particularly detailed theory of grounding has been developed in the PTT framework, e.g. [Poesio & Traum(1997), Poesio & Rieser(2009)].

[16] CRs of the form 'Why?' work differently. They have long distance coherence, as exemplified in (32b). For an account see [Ginzburg(2010a)].

as in the parenthesized readings. This provides justification for the assumption that the context that emerges in clarification interaction involves the accommodation of an issue, one that for ((39)a) assuming the sub-utterance 'Bo' is at issue could be paraphrased as ((39)g). The accommodation of this issue into QUD could be taken to license any utterances that are *CoPropositional* with this issue, where *CoPropositionality* is a relation between utterances I will introduce shortly. This will also allow in as relevant responses corrections, as in ((39)h):

(39) a. A: Is Bo leaving?

b. B: Bo? (= Who do you mean 'Bo'?)

c. B: My cousin? (= Do you mean my cousin?)

d. B: Who? (= Who do you mean 'Bo'?)

e. B: Which Bo? (= Who named 'Bo' do you mean?)

f. Who do you mean 'Bo'?

g. B: You mean Mo.

We can define *CoPropositionality* as follows:

(40) a. Two utterances u_0 and u_1 are *co-propositional* iff the questions q_0 and q_1 they contribute to QUD are co-propositional.

(i) qud-contrib(m0.cont) is m0.cont if m0.cont : Question

(ii) qud-contrib(m0.cont) is ?m0.cont if m0.cont : Prop[17]

b. q_0 and q_1 are co-propositional if there exists a record r such that $q_0(r) = q_1(r)$.

CoPropositionality for two questions means that, modulo their domain, the questions involve similar answers. For instance 'Whether Bo left', 'Who left', and 'Which student left' (assuming Bo is a student.) are all co-propositional. In the current context co-propositionality amounts to: either a CR which differs from MaxQud at most in terms of its domain, or a correction—a proposition that instantiates MaxQud.

Repetition and meaning–oriented CRs can be specified by means of a uniform class of conversational rules, dubbed *Clarification Context Update Rules (CCURs)*

[17]Recall from the assertion protocol that asserting p introduces p? into QUD.

in [Ginzburg(2010a)]. Each CCUR specifies an accommodated MaxQUD built up from a sub-utterance u1 of the target utterance, the maximal element of Pending (*MaxPending*). Common to all CCURs is a license to follow up *MaxPending* with an utterance which is *co-propositional* with MaxQud.

To make this concrete, we consider one specific CCUR Parameter identification, used to specify *intended content* CRs. ((41)) indicates that given u0, a sub–utterance token of MaxPending, one may accommodate as MaxQUD the issue 'What did spkr mean by u0'. Concomitantly, the next move must be co-propositional with this issue:

(41) Parameter identification

$$\begin{bmatrix} \text{preconds} : \begin{bmatrix} \text{Spkr} : \text{Ind} \\ \text{MaxPending} : \text{LocProp} \\ \text{u0} \in \text{MaxPending.sit.constits} \end{bmatrix} \\ \text{effects:} \begin{bmatrix} \text{MaxQUD} = \text{What did spkr mean by u0?} : \text{Question} \\ \text{LatestMove} : \text{LocProp} \\ \text{c1: CoProp(LatestMove.cont,MaxQUD)} \end{bmatrix} \end{bmatrix}$$

The formulation of this rule presupposes the existence of a relation $Mean$ that holds between the speaker of an utterance, the utterance, and the intended content. In general, we can identify this latter with the value instantiated by c-params for that utterance:

(42) Mean(A,u,c) iff u.c-param.spkr = A and u.c-param.x = c

This definition will enforce as a precondition for parameter identification that it can only pertain to sub-utterances that have a value for C-PARAMS.

5 Metadiscursive and Genre-based Relevance

Two other sources of relevance need to be mentioned, albeit briefly. The first seems relatively straightforward, though perhaps not so easy to capture formally, I will refer to it as *metadiscursive* relevance. The second is much more intricate and relates to domain sensitivity.

5.1 Metadiscursive Relevance

Irrelevance *implicatures* are an instance of metadiscursive interaction—interaction about what should or should not be discussed at a given point in a conversation:

(43) a. A: We have a serious problem with the drains, no?

b. B: I don't know.

c. B: Do we need to talk about this now?

d. B: I don't wish to discuss this now.

e. B: Whatever. Millie called yesterday.

A natural way to analyze such utterances is along the lines of the conversational rule QSPEC discussed in section 3.4: A introducing q gives B the right to follow up with an utterance about an issue we could paraphrase informally as *?WishDiscuss(q)*. Such a CCUR is sketched in ((44)):

(44) Discussing u?

$$\begin{bmatrix} \text{preconds} & : \text{DGB} \\ \text{effects} & : \begin{bmatrix} \text{spkr} = \text{preconds.addr} : \text{Ind} \\ \text{addr} = \text{preconds.spkr} : \text{Ind} \\ \text{r} : \text{AbSemObj} \\ \text{R: IllocRel} \\ \text{Moves} = \langle \text{R(spkr,addr,r)} \rangle \oplus \text{pre.Moves} : \text{list(IllocProp)} \\ \text{c1} : \text{Qspecific(R(spkr,addr,r),?WishDiscuss(pre.maxqud)} \\ \text{qud} = \langle \text{?WishDiscuss(pre.maxqud),pre.qud} \rangle : \text{poset(Question)} \end{bmatrix} \end{bmatrix}$$

Note that the rule is formulated to ensure that the original MAX-QUD, q0, has made it into B's QUD. One might think that a consequence of a responder's failure to accept q for discussion is that q will only resurface if explicitly reposed. There is evidence, however, that actually q remains in a CP's QUD even when not initially adopted, its very posing makes it temporarily DGB available:

(45) A: Who are you meeting next week?
B(2): No comment.
A: Why?
B: Personal reasons.
A: I see.
B(6): Oh, ok, Jill.

Here the original question has definitely *not* been reposed and yet B still has the option to address it, which he should be unable to do if it is not added to his gameboard before (45(2)). Thus, we can assume as a monotonic effect of querying that q enters the CP's QUD. In the case where metadiscussion occurs, ?WishDiscuss(q) gets pushed above q.

5.2 Genre-based Relevance

It is clear that a theory of dialogue requires a theory of domain or genre–sensitive coherence. This is crucial for explicating *initiating moves*—queries, assertions or other moves that occur where, intuitively, where there is no prior move to react to. But even for the more restrictive task at issue here, relevance of responses to queries relevance driven by the domain plays an important role, as emphasized by a vast literature in AI, going back at least to [Cohen & Perrault(1979), Allen & Perrault(1980)]. In (46) B's perfectly relevant response is not *about* the query A asked:

(46) A: How can I help you?
B: A second class return ticket to Darlington, leaving this afternoon.

The basic intuition one can pursue is that a move can be made if it *relates to the current activity*.[18] In some cases the activity is very clearly defined and tightly constrains what can be said. In other cases the activity is far less restrictive on what can be said:

(47) a. **Buying a train ticket**: c wants a train ticket: c needs to indicate where to, when leaving, if return, when returning, which class, s needs to indicate how much needs to be paid

b. **Buying in a boulangerie**: c needs to indicate what baked goods are desired, b needs to indicate how much needs to be paid

c. **Buying goods in a minimarket stationed in a petrol station**: c needs to show what she bought, s needs to check if c bought petrol and to tell c how much needs to be paid.

d. **Chatting among friends**: first: how are conversational participants and their near ones?

[18]The approach sketched here is inspired by work in [Larsson(2002)], work implemented in the GODIS system.

e. **Buying in a boulangerie from a long standing acquaintance**: combination of (b) and (d).

Trying to operationalize activity 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. There are at present remarkably few such taxonomies (though see [Allwood(1999)] for an informal one.) and we will not attempt to offer one here. However we can indicate how to classify a conversation into a genre. One way is by providing a description of an information state of a conversational participant who has *successfully* completed such a conversation. Final states of a conversation will then be records of type T for T a subtype of DGB_{fin}, here Questions No (longer) Under Discussion (QNUD) denotes a list of issues characteristic of the genre which will have been resolved in interaction:

(48) $\text{DGB}_{fin} = \begin{bmatrix} \text{Facts : Prop} \\ \text{QNUD = list : list(question)} \\ \text{Moves : list(IllocProp)} \end{bmatrix}$

In ((49)) we exemplify two genres, informally specified in (47):

(49) a. CasualChat:

$$\begin{bmatrix} \text{A : Ind} \\ \text{B : Ind} \\ \text{t: TimeInterval} \\ \text{c1 : Speak(A,t)} \vee \text{Speak(B,t)} \\ \text{facts : Set(Prop)} \\ \text{qnud : list(question)} \\ \text{c2: } \left\{\lambda P.P(A), \lambda P.P(B)\right\} \subset \text{ qnud} \\ \text{moves : list(IllocProp)} \end{bmatrix}$$

b. BakeryChat:

$$\begin{bmatrix} \text{A : Ind} \\ \text{B : Ind} \\ \text{t: TimeInterval} \\ \text{c1 : Speak(A,t)} \vee \text{Speak(B,t)} \\ \text{facts : Set(Prop)} \\ \text{qnud : list(question)} \\ \text{c2:} \left\{ \begin{array}{l} \lambda P.P(A), \lambda P.P(B), \lambda x.\text{InShopBuy(A,x)}, \\ \lambda x.\text{Pay(A,x)} \end{array} \right\} \subset \text{qnud} \\ \text{moves : list(IllocProp)} \end{bmatrix}$$

We can then offer the following definition of *activity relevance*: one can make a move m0 if one believes that that the current conversation updated with m0 is of a certain genre G0. Making move $m0$ given what has happened so far (represented in $dgb0$) can be *anticipated* to conclude as final state $dgb1$ which is a conversation of type G0:

(50) m0 is relevant to G0 in dgb0 for A iff A believes that there exists dgb1 such that $(dgb0 \bigoplus m0) \sqsubset dgb1$, and such that dgb1 : G0

6 Combining Relevance

In this section I offer some empirical application to the need for a internalized notion of relevance. I consider, in turn, its use in clarification requests and in the emergence of the inference that a given conversationalist does not wish to address a certain issue.

One can easily construct examples in which a CR is used to query the relevance of a given utterance:

(51) a. A: Horrible talk by Rozzo. B: It's very hot in here. A: What do you mean? B: Hard to sit still, let alone discuss Bordieu.

b. Marjorie: Don't touch that cos she hasn't had it yet. Dorothy: Does she eat anything? Marjorie: What do you mean? (British National Corpus)

An empirical caveat is in order here. 'What do you mean' is clearly NOT a purpose built CR for querying the relevance of an utterance. In practice, the vast majority of 'what do you mean' CRs, at least in the BNC, seem to be about literal content, NOT about coherence:

(52) a. Anon 6: No, there's nobody here much Richard: What do you mean there's nobody here, it's packed.

b. Cassie: You did get off with him? Catherine: Twice, but it was totally non-existent kissing so Cassie: What do you mean? Catherine: I was sort of falling asleep.

Pretheoretically this is perhaps not surprising, given that (perceived) complete lack of coherence is rare; whereas indeterminacy of content is a consequence of lexical and phrasal context dependence.

One could argue that CRs such as (51) are simply instances of the normal parameter identification rule discussed in section 4. Even if that were the case, there remains some work to be done to accommodate such CRs, above and beyond 'canonical semantically oriented' CRs discussed in section 4. The one significant difference of relevance CRs is that whereas the content–oriented CRs discussed previously revolved around partially instantiated C-PARAMS, here the trigger is typically the irrelevance of a fully instantiated utterance. In other words, failure here occurs when there is an attempt to integrate a fully instantiated utterance in the DGB. The answer to such a CR will not in general be represented in the DGB, in contrast to other CRs where it could be found in C-PARAMS or PHON of the responder. This means that, arguably, we need to offer an alternative definition for the Mean predicate to the one we offered in section 4, which will be applicable to speaker meaning associated with entire utterances. What we would need would be a definition along the following lines—identifying the speaker meaning with the maximal element of the agenda of the utterance's speaker:[19]

(53) Given $u^{content}$: IllocProp, Mean(A,u,c) iff u.c-param.spkr = A and A.private.maxagenda = c

One cannot, consequently, say that a treatment of relevance–oriented CRs *inevitably* involves as a trigger an overt reference to Relevance. But even if one subsumed their analysis to parameter identification, then at some level, be it a

[19]We could of course restore uniformity by associating a contextual parameter with the entire utterance as well, one which by default might be identified with the 'semantic content', but which could in principle be distinct. This could be implemented, for instance as a contextual parameter which conjoins on to content at the root clause level:

(i) $\begin{bmatrix} \text{c-params} : \left[\text{p} : \text{IllocProp}\right] \\ \text{content} = \text{hd-dtr.cont} \wedge \text{c-param.p} : \text{IllocProp} \end{bmatrix}$

When the two are identical, then the contextual parameter has no effect on the sentential content.

private, non-conventionalized one, one needs to appeal to (lack of) Relevance as a trigger.

The other source motivating reference to Relevance is in a rule underwriting lack of wish to address an utterance.[20] A prototypical example in this respect is given in ((54)a). Two further examples from literary texts convey a similar import:

(54) A: Horrible talk by Rozzo. B: It's very hot in here. **Implicates**: B does not wish to discuss A's utterance.

a. Rumpole: Do you think Prof Clayton killed your husband? Mercy Charles: Do you think you'll get him off? ('Rumpole and the Right to Silence', p. 100)

b. Harry: Is that you James? Stella: What? No, it isn't. Who is it? Harry: Where's James? Stella: He's out. Harry: Out? Oh, well, all right. I'll be straight round. Stella: What are you talking about? Who are you? (Pinter, *The Collection*, p. 133)

In current terms we could formulate the inference as in ((55)):

(55) ¬Relevant(u^{content},dgb) $\mapsto$
A does not wish to address dgb.LatestMove.

What then does Relevance amount to? Pretheoretically, Relevance relates an utterance u to an information state I just in case there is a way to successfully update I with u. Let us restrict attention for now to the case where the input context is a query. Given a set of conversational rules $\mathcal{C}$, a grammar $\mathcal{G}$ and an information state $I_0 : TIS$, an utterance u is $\mathbf{U(tterance)}_{\mathcal{C},\mathcal{G}}{}^{I_0}$-**relevant** iff there exist $c_1, \ldots, c_{k+1} \in \mathcal{C}, T_u \in \mathcal{G}, k \geq 0$ such that $c_1(I_0) = I_1, \ldots, c_{k+1}(I_k) = I_{k+1}$, where C's information state I_0 satisfies ((56)a); where by means of a sequence of updates the locutionary proposition $p_u = prop(u, T_u)$ becomes the value of LatestMove (condition ((56)b); and the final element of the sequence of updates I_{k+1} is such that one of the conditions in ((56)c-f) is satisfied—u is either q–specific, an appropriate CR, relates to the issue of willingness to discuss q, or is genre–relevant:

(56) a. I_0.DGB.LatestMove = v; v.content = Ask(A,q),

b. $I_{k+1}.DGB.LatestMove = p_u$

[20] In seeking to underwrite this inference via conversational rule there is no inconsistency with a Gricean view that such an implicature can be explicated in terms of calculations made by rational agents on the basis of apparent violations of the Cooperative Principle etc. This rule represents a "short circuited" version of the Gricean account.

c. $p_u.content$ is q–specific relative to I.DGB, Or

d. $p_u.content$ is CoPropositional with some question q0 that satisfies q0 = CCUR1.effects.maxqud($I_0.DGB.MaxPending$) for some CCUR CCUR1, Or

e. $p_u.content$ is q_0–specific, where q_0 is the question ?WishDiscuss(B,q), Or

f. One of C's beliefs in I_0 is that: for some G0 there exists dgb1 such that $(I_0.DGB \bigoplus p_u) \sqsubset dgb1$, and such that dgb1 : G0

A number of remarks can be made about (56), primarily about the relata of this notion.

- The definition is relative to both the set of conversational rules and to a grammar from which the types T_u from which locutionary propositions originate.
- Relevance is, by and large, DGB oriented. Only ((56)f) explicitly involves reference to the entire information state.

As for irrelevance implicatures, we can offer a "short circuited" version of the Gricean account—irrelevance is a means of non-grounding the previous utterance, itself an instance of a more general process of ignoring commonly perceived events. The short circuited version takes the form of the update rule in ((57))—given that MaxPending is *irrelevant* to the DGB, one can make MaxPending into LatestMove while updating Facts with the fact that the speaker of MaxPending does not wish to discuss MAX-QUD:

(57)
$$\left[\begin{array}{l}\text{preconds: } \left[\begin{array}{l}\text{dgb : DGB}\\ \text{c: } \neg\text{Relevant(maxpending}^{content}\text{,dgb)}\end{array}\right]\\ \text{effects : } \left[\begin{array}{l}\text{LatestMove = pre.pending : LocProp}\\ \text{Facts = pre.Facts} \cup\\ \left\{\neg \text{ WishDiscuss(pre.spkr,pre.maxqud)}\right\}.\end{array}\right]\end{array}\right]$$

Note that this does not make the *unwillingness to discuss* be the *content* of the offending utterance; it is merely an inference. Still this inference will allow MAX-QUD to be downdated from the DGB via the general mechanisms that regulate QUD downdate in conjunction with FACTS update.

7 A Pilot Study

The definition in (56 allows us to operationalize the concept of relevance—it can be used as the basis for corpus studies which test how well the proposed notion classifies responses to questions. I mention here a rough pilot study conducted in the BNC performed to assess the viability of the proposed notion of relevance.[21]

The study involved 50 randomly selected wh–queries from the K block of the BNC, chosen to be composed in rough accordance with the distribution of such queries in the BNC: 30% what interrogatives, 25% where interrogatives, 10% who interrogatives, 20% when interrogatives, 15% how interrogatives. The non-zero classes that emerged are given in table 1: here 'About' are answers that are about the question asked, 'Don't know' are responses where the responder communicates 'I don't know', 'Indirect about' involve a response that entails an answer that is about the question asked, and 'Other' is the catch-all category for the rest:

Response Type	Number of responses
About	36
Clarification Request	5
Don't know	4
Indirect About	3
Other	4
Total	52

Table 1: Distribution of responses to wh–questions in small random sample of the BNC

8 Conclusions

A common slogan in work on the semantics of interrogatives is 'to know the meaning of a question is to understand what counts as an answer to that question.' This paper addresses a surprisingly neglected variant, which constitutes a fundamental task for a theory of conversational interaction, namely 'to know the meaning of a query is to understand what counts as a relevant response to that query.'

Relevance amounts to a relation between an utterance and an information state where the utterance can successfully update the information state whose most recent move is a query. I have elucidated four dimensions of this notion: responses that are question–specific, metacommunicative, metadiscursive, and genre–specific.

[21] A more detailed study will be presented in a later version of this paper.

I have formalized this notion using the dialogue theory KoS and the formalism of Type Theory with Records. The notion of relevance that emerges is primarily one grounded in publicized contextual information, though it has some important unpublicized components, primarily those relating to genre–dependent knowledge.

I have motivated the need for a notion of relevance internalized in the theory of meaning via its application in a class of clarification requests ('What do you mean') and the celebrated Gricean implicatures of lack of desire to address an utterance.

Beyond this of course the big challenge for a theory of relevance is to show that it is empirically adequate. One way of meeting this challenge is via corpus studies, a challenge we hope to meet in the future.

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