

QUESTIONS IN DISCOURSE
Lecture 1: Alternatives and Guiding Intentions

The goals of the course:

1. to motivate and sketch a general framework for pragmatic analysis
 - based on the assumption that our semantics is compositional and truth conditional, and that the two go hand in glove; and
 - taking the results from earlier work on anaphora, domain restriction, and presupposition to argue that we need a dynamic semantics, one in which context changes in the course of interpretation.
2. to very briefly illustrate its utility in the investigation of a few classic topics in pragmatics, the study of how context bears on interpretation:
 - prosodic Focus and domain restriction
 - presupposition, projection, and accommodation
 - the resolution of anaphora and other indexical elements given by the semantics
3. to speculate a bit about what this tells us about human linguistic competence, its acquisition and exercise by native speakers

I. Basic Hypotheses

- i. Discourse is a cooperative inquiry.
- ii. Inquiry is the investigation of alternatives: the comparison of different possible ways things might be in the interest of determining which come closest to reflecting the way things are. This much is due to Stalnaker.
- iii. Questions pose a subject matter for inquiry: a set of alternatives to investigate. This is the semantic content of interrogative sentences, which are the canonical means of posing questions, though by no means the only way:

- (1) *CASSIE went to Dubrovnik?* implicating ‘who went to Dubrovnik? Was it really Cassie?’ vs.
- (2) *Cassie went to DUBROVNIK?* implicating ‘where did Cassie go? Was it really Dubrovnik?’
- (3) *I wonder whether you know which train to Sacramento is most direct.*
- (4) [waiter, taking order:] *For your main course, you may choose HAGGIS or TRIPE.*
L* H- L+H* L-L%

Note that (1) and (2) implicate something richer than just the yes/no question corresponding to their indicative content. In this respect, they have something in common with the response in (5), from Roberts (1996/2012) (and see Büring 2003):

- (5) A: When are you going to China?
B: I’m going to CHINA in APRIL. [implication: B is going somewhere other than China]
L+H* L H% H* L L%

In the right context, (3) amounts to a polite question about which train is more direct; (4) may be used to ask which dish the addressee would prefer—with narrow, contrastive focus on the two objects, it is an alternative question.

More hypotheses:

- iv. If an inquiry is to be rational, it involves a commitment on the part of the interlocutors to concentrate on the agreed-upon subject matter.

Don't change the subject.

What's that got to do with the price of eggs?

This commitment amounts to **an intention to address the agreed-upon question.**

Some hypotheses about intentions from the philosophy of action and Planning Theory in AI:

- v. For an agent to adopt an intention involves a commitment to realizing that intention, to achieving any associated goals; one who holds a sincere intention will only give up that commitment when either the goals involved are achieved, or they are determined to be practically unachievable.
- vi. **Intentions guide action.** Agents behave as they do in view of their goals and the intention to achieve them. Moreover, we know this about each other (via our *theory of mind*), so that when we know what someone intends, we can abductively infer that their behavior reflects a strategy for achieving their goals.

Some corollaries to (v) and (vi):

- vii. A rational agent only adopts an intention if she believes it can be achieved.
- viii. Rational agents make their goals compatible, and approach them in a systematic way.

And my own assumption, based on (iv), and (viii):

- ix. Our discourse goals—addressing the agreed-upon questions which define the interlocutors' inquiry—typically subserve our domain goals—the things we want to achieve in the world, apart from discourse.

The central hypothesis:

- x. **Questions both drive and constrain interpretation in discourse.**

Given that questions reflect cooperatively adopted intentions, and given the nature of intention and its relation to action, it isn't hard to see how questions drive discourse. But why do we say that the Question Under Discussion *constrains* interpretation?

Before you read further, watch this video, following the instructions carefully:

<http://www.youtube.com/watch?v=vJG698U2Mvo>

The phenomenon it illustrates is called *inattentional blindness*. It illustrates how intention (here, to perform a task) guides attention. What is at issue is what you attend to, constraining what you are likely to see, what is **salient**.

A further hypothesis is an instance of this general principle:

- xi. Questions and other evident intentions in discourse guide interlocutors' attention: As in inattentive blindness, attention to the Question Under Discussion can help to mask competing interpretations of an utterance or constituent if they are not obviously relevant to the resolution of that question.

Hypothesis (xi) will serve as the foundation of a theory of Saliency in discourse, to be discussed Thursday and Friday in this course.

II. Terminology: Semantics, Pragmatics and the Grammar

People mean different things by the expressions **semantics** and **pragmatics**. I'm not going to try to legislate, but simply tell you how I'm going to use the terms, in the hope of heading off any confusion:

Semantics is that component of the grammar of a language specifies how the **conventional content** of an utterance is compositionally determined, as a function of the conventional content of its parts and the syntactic structure of the utterance. I.e., this is a generative account of conventional content.

Conventional content underdetermines the proposition expressed/question posed/suggestion made by an utterance. Consider anaphoric triggers: Their conventional content tells the addressee to look for a contextually salient antecedent; it doesn't tell us what that antecedent might be. And it is only when that antecedent is retrieved that we can recognize the proposition that the speaker intended to convey by the utterance as a whole.

Hence this notion of *conventional content* isn't what philosophers of language call *content*. E.g. see Kaplan (1977), where Content is the proposition expressed once the context of utterance has set the values for any indexical expressions. Most theoreticians take the context to also give values for pronouns and other anaphoric expressions, e.g. (implicit) domain restriction (von Stechow), Modal Bases and Ordering Source (Kratzer), etc.

The object of study in pragmatics: utterance meaning, and its relationship to the conventional content of the linguistic expression uttered.

Utterance: an ordered pair of a linguistic expression and a context of utterance. (Barwise 1971)
Here, by *linguistic expression* I mean a linguistic string under a structural analysis, plus an independently generated prosodic structure, with an association between the two.

Grice's notion of utterance meaning:

"U meant_{nn} something by uttering x" is true iff, for some audience A, U uttered x intending:

- (1) A to produce a particular response *r*
- (2) A to think (recognize) that U intends (1)
- (3) A to fulfill (1) on the basis of his fulfillment of (2). (Grice 1957)

What is the intended response by the addressee?

Consideration of a proposed addition to the common information of the interlocutors.

But it is essential to understand that conventional content radically under-determines meaning_{nn}.

- There *are* conventional hooks that help to both indicate and constrain appropriate context of use. e.g. Focus, Topic-marking, Discourse Particles, conventional presupposition triggers like pronouns, *too*, etc.
- But even these under-determine the relevant aspects of context. E.g. English presupposition trigger *too* doesn't tell us what's presupposed, but only (in conjunction with the focal structure of the utterance) constrains what that might be. Or domain restriction that bears on truth conditions:

(6) [Context: You and I are sitting in a café discussing how to understand Sperber & Wilson's (1985) definition of Relevance, and I say:]

I see it now!

[Even though I'm holding a coffee mug by the handle right under your nose and shaking it for emphasis, you don't take *it* to refer to the mug.] (Roberts 2010)

(7) A: What's up with John_i?—I saw him talking with Mac_k earlier.

B: He_{i/#k} found a dent in his fender.

(8) The birds will get hungry (this winter).

(8') If Edna forgets to fill the birdfeeder, she will feel very bad.

The birds will get hungry. (Roberts 1989)

But despite the fact that conventional content so clearly underdetermines intended meaning, human interlocutors are apparently remarkably good at grasping what is intended in this way. Note that the following arguably follows from Grice's notion of meaning_{nn}:

Retrievability: In order for an utterance to be a rational, cooperative act in a discourse interaction *D*, it must be reasonable for the speaker to expect that the addressee can grasp the speaker's intended meaning in so-uttering in *D*.

In view of the gap between conventional content and conveyed meaning, this is a strong principle, since it requires that cooperative speakers expect that their *uniquely* intended meaning_{nn} can be recognized as such by an addressee.

So, the central problem for pragmatics is:

How do addressees regularly, easily retrieve a speaker's intended meaning, given that it is underdetermined by the conventional content of what she says?

I.e.: What might be the grounds for the assumption of Retrievability on the part of a speaker?

Here are some corollary issues:

a) **What is a context, that it regularly facilitates efficient, accurate meaning-retrieval?**

Addressing this question is a pre-condition on an adequate formal account of pragmatic phenomena.

b) When and how do conventional content and (which aspects of) context interact?

This is the nuts-and-bolts part, the linguistic engineering. We want a psychologically plausible, hence compositional, account. And given the evidence for embedded implicature and local presupposition-satisfaction, we need a dynamic account, one in which context is updated in the course of interpretation.

With respect to issue (a), Lewis (1970) offers the following excellent advice about semantics:

In order to say what meaning *is*, we may first ask what a meaning *does*, and then find something that does that.

transposed for pragmatics:

If you want to know what a context of utterance is, figure out what it does (i.e., how it bears on interpretation) and then find something that does that (to model the context).

So as the foundation of an adequate, *falsifiable* pragmatic theory, we would ideally take into consideration *all the ways that context influences interpretation*, and then find something that does all that, a model for the context of utterance. In particular, we want to:

- determine the kinds of factors in context—the semantically relevant contextual parameters—which arguably bear on interpretation in a regular way, on the basis of detailed examination of lots of actual linguistic data and discovery of patterns therein.
- figure out how to perspicuously model such contextual parameters in an integrated framework, in such a way that we can then control for them in constructing contexts.
- hypothesize about which particular parameters bear on the meaning of particular types of utterance (in virtue of some aspect of their conventional content), and
- to test such hypotheses, manipulate the relevant parameters of context (developing contextual minimal pairs) to determine whether the understood meaning varies as predicted.

Hypothesis:

- xii. **The intentional structure of a discourse interaction** is designed (has developed) to help satisfy Retrievability, to make it be reasonable to intend that one's audience will recognize that one intends them to both grasp the proposition one intends to express (or the question or suggestion posed) and recognize that one proposes that this proposition is true (question is appropriate for discussion, etc.).

It is discourse structure that makes it reasonable for a speaker making an assertion to intend that her audience will recognize that she intends them to both grasp the proposition she intends to express and recognize that she proposes that this proposition is true (or not, in the case of ironic statements).

Several authors (Carlson, Ginzburg, van Kuppevelt, Roberts) independently converge on the claim that this all has to do with the question under discussion. Examples like the following argue that it's relevant even in classical deixis:

- (9) [Tim and Margaret are sitting at a conference table in her psycholinguistics lab, working on a grant proposal for some eye-tracking experiments. Tim is making notes on his laptop computer, not a MacIntosh brand.]
 Margaret: How do you like your laptop?
 Tim: It's not bad, but it's getting kind of old. I wish I had a Mac. Macs are far better for graphics, and it turns out that I'm doing a lot more graphics than I'd expected.
 Margaret: [gesturing with her thumb over her shoulder, in the direction of her desk in the middle of the room] I just got [that]_F last year.
 [In the direction Margaret is pointing there's a lot of stuff: a desk with a big pile of papers and a flat screen Mac computer monitor on it, past the desk an eye-tracker, past that a wall calendar.]
- (9') Margaret: How do you like your laptop?
 Tim: It's not bad, but it's getting kind of old. Anyway, let's get back to business. What do you think of this budget?
 Margaret: [gesturing with over her shoulder, in the same direction as in (1)] Could we add some money to replace that?

A formal theory of pragmatics, and of how it interfaces with conventional content in the course of compositional semantics is designed to capture this intentional structure. Following Wittgenstein and Lewis (1979) *inter alia*, we call discourse—this intentionally structured interchange—a *language game*, and talk about the context of interpretation as a *scoreboard*.

III. The Scoreboard in a Language Game

The basic framework in Roberts (1996/2012) starts from the hypotheses discussed above regarding the role of alternatives and intentions in discourse, and especially the assumption that: Discourse goals are questions, often implicit, which guide the interlocutors' inquiry. You can think of these as issues or topics under discussion.

The main goal of the game is to maximize the amount of shared information about the way things are, i.e. the interlocutors' Common Ground.

We can view this goal as that of answering the Big Question, *What is the way things are?*, and attempt to arrive at a partial answer to asking subquestions and organizing these into logically constrained strategies of inquiry.

Relevance encodes commitment to those goals: It requires that whatever we say address the most immediate question under discussion.

How a move addresses the accepted question under discussion:

- if a question, it is a sub-question of the accepted question
- if an assertion, it is an (at least partial) answer to the accepted question

Assertions/answers, if accepted, are payoffs, in which the interlocutors achieve their immediate goals, answering the question under discussion.

The payoff of an accepted answer is addition of the information which it contains to the Common Ground.

Principle Elements of a Discourse Game:

Goals: to come to agree on the way things are in the world, i.e. to maximize the **common ground** of the interlocutors, thereby reducing the **context set** to a singleton set, the

"actual world" (Stalnaker 1979). This usually involves a number of more specific sub-goals; see Strategies.

Rules: constraints on interlocutors' linguistic behavior. Two kinds:

- conventional: proper linguistic rules; e.g., syntactic rules, compositional semantic rules, etc.
- conversational: not linguistic *per se*; follow from rational considerations in view of the goals of the game (e.g., Grice's maxims)

Moves: Linguistic behaviors which respect the Rules and are classified according to their relationship to the goals of the game:

- **set-up moves:** questions; these set up immediate goals [**to answer the question**] requests and other moves made using imperative mood are also set-up moves, but they set up domain goals, and not just discourse goals
- **pay-off moves:** assertions, the answers to questions; these achieve the established discourse goals

Each move has both **presupposed content** and **proffered content** (for questions, a set of alternatives; for assertions, what is asserted)

A move may be either **accepted** or **rejected**.

Strategies: ways of sequencing moves, in view of their logical relations, to achieve accepted goals.

In 1996, I developed a formal theory of context which reflects these assumptions, and called this this *Info(rmation)Str(ucture)* of a discourse, because it is intended as a structure on the information shared by the interlocutors, the "scoreboard" in the language game they're playing (Lewis 1979). But another sense of that term has subsequently become standard: the way in which the linguistic expression is structured *as a reflection of contextual factors*. I hereby capitulate to general usage, and am now more inclined to call this notion of context **the scoreboard or information state of a discourse**. Here was the original:

- (10) The information structure for a discourse D is a tuple,
InfoStr $_D$ = $\langle M, Q, A, <, \text{Acc}, \text{CG}, \text{QUD} \rangle$, where:
M is the set of (setup and payoff) moves in the discourse.
Q \subseteq **M** is the set of questions (setup moves) in **M**, where a question is a set of propositions.
A \subseteq **M** is the set of assertions (payoff moves) in **M**, where an assertion is a set of possible worlds.
 $<$ is the precedence relation, a total order on **M**; $m_i < m_k$ iff m_i is made/uttered before m_k in D ; the order of any two elements under $<$ will be reflected in the natural order on their indices, where for all $m_i, i \in N$.
Acc \subseteq **M**, is the set of accepted moves.
CG is a function from **M** to sets of propositions, yielding for each $m \in M$ the common ground of D just prior to the utterance of m . Further, we require that:
a. for all $m_k \in M$, $\text{CG}(m_k) \in \cup_{i < k} (\text{CG}(m_i))$,
b. for all $m_k \in M$, $\text{CG}(m_k) \in \{m_i: i < k \text{ and } m_i \in \text{Acc} \setminus Q\}$, and
c. for all $m_k, m_i \in M, i < k$,
i. the proposition that $m_i \in M$ is in $\text{CG}(m_k)$,

- ii. if $m_j \in Q$, the proposition that $m_j \in Q$ is in $CG(m_k)$,
- iii. if $m_j \in A$, the proposition that $m_j \in A$ is in $CG(m_k)$,
- iv. if $m_j \in Acc$, the proposition that $m_j \in Acc$ is in $CG(m_k)$,
- v. for all propositions $p \in CG(m_j)$, the proposition that $p \in CG(m_j)$ is in $CG(m_k)$, and
- vi. whatever the value of $QUD(m_j)$, the proposition that that is the value of $QUD(m_j)$ is in $CG(m_k)$.

QUD, the questions-under-discussion stack, is a function from M (the moves in the discourse) to ordered subsets of $Q \cap Acc$ such that for all $m \in M$:

- a. for all $q \in Q \cap Acc$, $q \in QUD(m)$ iff
 - i. $q < m$ (i.e., neither m nor any subsequent questions are included), and
 - ii. $CG(m)$ fails to entail an answer to q and q has not been determined to be practically unanswerable.
- b. $QUD(m)$ is (totally) ordered by $<$.
- c. for all $q, q' \in QUD(m)$, if $q < q'$, then the complete answer to q' contextually entails a partial answer to q .

But I now believe that to really understand discourse context, we have to generalize from the notion of the QUD to look more broadly at how it reflects the intentional structure of a rational interaction in a cooperative language game. E.g., consider:

- (11) A: Do you want some coffee?
 B: Coffee would keep me awake. (Sperber & Wilson 1985)

And recall Grice's (1967) classic illustration of his maxim of Relation: a car is broken down by the side of the road, the gas tank cap open, the motorist beside the car. A good Samaritan stops and approaches in a friendly manner, saying "There's a gas station around the corner." Then, assuming that the goal adopted by the Samaritan was to help the driver find petrol, it is reasonable to take him to implicate that so far as he knows the station is open and has petrol to sell, since the mere existence of the station would not by itself address the adopted goal.

And then there are imperatives, which arguably propose a goal for the addressee to adopt. What is the canonical pragmatic function of utterance of an imperative?

So we need to look more deeply at the intentional structure of a discourse interchange, and not just at the discourse goals reflected in the set of Questions Under Discussion.

Appendix A of Afterword (Roberts 2012):

(12) **Scoreboard of a rational discourse interaction D :**

At any given point t in D , the information shared by the interlocutors is structured as follows:

I , the set of interlocutors at t

G , a set of sets of goals in effect at t , such that

for all $i \in I$, there is a (possibly empty) G_i which is the set of goals which i is committed at t to trying to achieve, and

$G = \{ G_i \mid i \in I \}$.

$G_{\text{com}} = \{ g \mid \forall i \in I: g \in G_i \}$, the set of the interlocutors' common goals at t .

$GQ = \{ g \in G_{\text{com}} \mid \text{there is some } Q \in \text{QUD and } g \text{ is the goal of answering } Q \}$

M , the set of moves made by interlocutors up to t , with distinguished sub-sets:

$A \subseteq M$, the set of assertions

$Q \subseteq M$, the set of questions

$S \subseteq M$, the set of suggestions

$\text{Acc} \subseteq M$, the set of accepted moves

$<$ is a total order on M , the order of utterance

CG , the common ground, the set of propositions treated as if true by all $i \in I$ at t

(This includes propositions about the discourse scoreboard itself.)

DR , the set of discourse referents, corresponding to entities entailed to exist in CG

$\text{QUD} \subseteq Q \cap \text{Acc}$, the ordered set of questions under discussion at t , s.t.

for all $Q \in \text{QUD}$ there is a $g \in G_{\text{com}}$ such that g is the goal of answering Q , and

for all $Q \in \text{QUD}$, it is not the case that CG entails an answer to Q

For all $i \in I$, if i is a sincere, competent and cooperative interlocutor in D , we can use GQ to characterize two kinds of publicly evident goals held by i (at time t):

Discourse Goals of $i = GQ$

Domain Goals of $i = G_i \setminus GQ$

$G_{\text{com}} \setminus GQ$: the set of common Domain Goals of all the interlocutors

As discussed above, ideally the intentions of a rational agent are consistent. Hence, one's discourse goals are ideally consistent with, and presumably (on the assumption that there are other things more important than linguistic inquiry) subservient to one's domain goals. Of course, if it is clear that individual interlocutors have goals which are not common, and which limit their willingness to share information, this can be captured in the proposed scoreboard. For example, if a hostile witness in a trial is asked whether the accused took money from his firm and answers *He regularly wrote checks to cover his expenses*, one should not take this reply to necessarily be a complete answer to the question, as all good prosecuting attorneys know. That is, the witness will uncooperatively construe the question itself in the narrowest possible way (making the context willfully defective), to avoid having to lie or to give information that might serve the prosecution; but given her obvious overarching personal goal of giving as little information as possible, this is predictable.

The schematic scoreboard above constitutes **a theory of the context of utterance**. It is idealized, so as to permit us to make predictions about what a speaker reasonably meant by a given

utterance. As in Stalnaker (1979), it is important to understand that not all the information in the CG of the scoreboard need be introduced linguistically. Some propositions in CG may represent background information of the participants, perceptually accessible information, etc.

Sarah Moss (p.c.) notes that insofar as all the information about the moves made and whether they were accepted might be expected to be reflected propositionally in the CG, one might argue that a distinct QUD is otiose. However, I would argue that although from the CG as described we can retrieve the QUD at any given point in the discourse, these two elements of the scoreboard are functionally distinct in that (a) they play different roles in constraining felicity and driving scoreboard update, and (b) they themselves display different patterns of change over the course of update. With respect to the (b), CG is (ideally) monotonic, while QUD is not—as the Pragmatics of Questions suggests, ideally questions are ultimately taken off the QUD stack when answered (or given up as practically unanswerable). But point (a) is, I think, even more important, and bears on the fundamental insight behind this approach to pragmatic theory:

This scoreboard reflects a game which is fundamentally structured and constrained by rationally pursued intentions.

Cooperative interlocutors pursue the particular goals mutually adopted via making three central kinds of moves, or utterances, in discourse—assertions, questions and suggestions. Each of these kinds of moves affects the score, i.e. leads to the update of the scoreboard for the utterance, doing so in a way particular to that kind of move:

Pragmatics of Assertion: (following Stalnaker 1979)

If an assertion of α is accepted by the interlocutors in a discourse D , $|\alpha|^D$ is added to CG.

Pragmatics of Questions: (Roberts 1996)

If a question $?\alpha$ is accepted by the interlocutors in a discourse D , then $|\alpha|^D$, a set of propositions, is added to the QUD in D . A question is removed from QUD iff either its answer is entailed by CG or it is determined to be unanswerable.

Pragmatics of Suggestions: (Roberts 2004; see also Portner 2007)

If a suggestion posed by $!P$, P a one-place predicate, is accepted by the intended addressee i in a discourse D , $|P|^D$ is added to G_i , the set of i 's goals in D , and $|\text{intend}(i, [P(i)])|^D$ is added to CG. Once an intention has been fulfilled or it is determined that the intended agent i cannot practically fulfill it, it is removed from G_i .

Because a rational agent's intentions are ideally intrinsically bound up with her plans for action (Bratman 1987), we have:

Rational Cooperation in a Discourse D : Make your utterance one which promotes your current intentions in D . (cf. Grice's Cooperative Principle 1967, and its counterpart in Thomason 1990)

Since all of the questions in QUD are reflected in G_Q , any rational, cooperative interlocutor should address the QUD (unless more important goals interfere):

An utterance *m* **addresses** a question *q* iff *m* either contextually entails a partial answer to *q* (*m* is an assertion) or is part of a strategy to answer *q* (*m* is a question) or suggests an action to the addressee which, if carried out, might help to resolve *q* (*m* is a suggestion, introduced with utterance of an imperative).¹

A move *m* is **Relevant** to the question under discussion *q* iff *m* addresses *q*.
(Roberts 1996)

IV. Comparison with other approaches to pragmatics and discourse

A. Relevance Theory

To see the way in which this characterization differs from previous views, consider Sperber & Wilson (1985). Offering a modification of the vague notion of relevance in Grice (1967), their Relevance is a general constraint on felicitous utterance captured by two requirements: a requirement of sharing maximum amounts of information (close in spirit to Stalnaker's (1979) motivation for assertion), and a requirement of doing so in an optimally efficient manner—which they characterize as a cognitive constraint based on the nature and limitations of the human mind that engages in discourse. There is something intuitively right about the latter, and Sperber & Wilson offer a rich range of examples demonstrating its utility. But like a number of other theories of pragmatics following Grice, it fails to address a crucial question: Relevance is a relational notion. In order to guarantee felicity, what must an utterance be relevant *to*? Simply facilitating the maximum number of inferences while respecting optimal ease does not address this issue. In this respect Grice himself gives us some hints: Although the maxim of Relation itself is quite terse — “Be relevant” — Grice's maxims of Quantity suggest that he understood the felicity of an utterance to be relative to the conversational purposes of the interlocutors at that point in the discourse:

Quantity:

- 1) Make your contribution as informative as is required (for the current purposes of the exchange).
- 2) Do not make your contribution more informative than is required. (Grice 1967:27)

More generally, assume that the conversational maxims and other commonly assumed guidelines for conversational felicity in the literature amount to rationally motivated rules for felicitous conversation, rules exploited by speakers to assist their interlocutors in grasping the intended meanings of utterances. Rules only make sense as part of a collective *endeavor*. Call such an endeavor a game. But a game is not a game without goals. What are these goals in a language game? What motivates us to make a move—to utter something?

¹ See Groenendijk & Stokhof (1984), adopted in Roberts (1996), for what it is to be a partial answer—basically entailing the negation of at least one cell of the partition corresponding to the QUD. And (roughly) a reply to a question contextually entails an answer if it does so in conjunction with other propositions in the common ground.

Sperber & Wilson's characterization of Relevance makes our information sharing appear to be purely quantitatively driven: According to them, what matters is the sheer number of inferences one can draw easily—anything goes, the faster the better, Wild West pragmatics. In terms of the framework recommended here, this would amount to always addressing nothing more specific than the Big Question.

The perspective I have offered is more qualitative and constrained: What matters is addressing a more limited, circumscribed goal, resolving the immediate question accepted for discussion. Quantity, too, has its natural limit, given this goal: We need just enough of the right kind of information to resolve the question; in his closely related work, Jonathan Ginzburg (2012) has explored what this means in great detail; I recommend it to you. Further, I think it is quite plausible that the characterization I have given of Relevance is motivated by cognitive efficiency in very specific ways: We share information in a constrained, focused way in order to optimize the interface between linguistic processing *per se* on the one hand, and on the other practical reasoning, and information retrieval and storage. Just as work in psycholinguistics has shown that lexical access is facilitated by use of vocabulary in a particular encyclopedic domain, it seems plausible that interlocutors' focus on a QUD activates general information in the encyclopedic domain pertaining to the QUD, making it easier and faster, on the basis of what is said, to draw the *relevant* inferences from that domain, to store them efficiently when drawn, and to use them in conjunction with other information in that domain to reason practically about what the speaker means (in Grice's sense; see Thomason, Stone & DeVault (2006) on practical reasoning in discourse).

B. Rhetorical Relations Theory and SDRT: Building blocks for strategies of inquiry

Strategies of inquiry (defined formally in Roberts 1996) are sequences of moves designed to (at least partially) satisfy the aims of the game, while obeying the game's constraints. A reasonable strategy to answer the questions under discussion, which may themselves be quite difficult, will involve a plan to do this by approaching sub-goals (addressing sub-questions) which are easier to achieve and are logically related to each other in such a way as to facilitate achieving the main goal. We can define an entailment relation on questions, following Groenendijk and Stokhof (1984), p.16: One *interrogative* Q_1 entails another Q_2 iff every proposition that answers Q_1 answers Q_2 as well. (This presupposes that we're talking about complete answers, for otherwise the entailments can actually go the other way around.) E.g.: *What do you like?* entails *What food do you like?*. We might call Q_1 in such a relation the *superquestion*, and any Q_2 which it entails a *subquestion*. On the other hand, if we can answer enough subquestions, we have the answer to the superquestion. And even answering a particular question may have several parts, involving presenting and arguing for complex information. Again, there may be better or worse ways of presenting this complex information in order to maximize its inferential potential for our interlocutors, and determining how to do so is part of the strategy we develop. Given the ultimate aim of discourse and the rationality of the participants, these types of relations are the principal factors that structure our moves.

As discussed above, besides the discourse goal of inquiry in its most general sense, we usually have goals in the real world, things we want to achieve quite apart from inquiry, our *domain*

goals. And our domain goals, in the form of deontic priorities, generally direct the type of inquiry which we conduct in conversation. We are, naturally, most likely to inquire first about those matters that directly concern the achievement of our domain goals. Once we've committed ourselves to a given question, i.e. we intend to answer it, then we pursue it until and unless it is either answered or it becomes clear that it isn't presently answerable. But the interlocutors' strategy in this pursuit may include the decision to pursue answers to sub-questions, i.e. a series of related questions may realize a strategy to get at the answer to the most general, logically strongest question among them.

Hence, a strategy of inquiry will have a hierarchical structure, based on a set of questions partially ordered by entailment. Relative to each such question in the resulting partial order, we pursue some rhetorical strategy or other to address that question. Things are actually more complex than this, as questions in an actual strategy may be only logically related in view of certain contextual entailments. But this is the basic nature of strategies, and in what follows I will assume that they have this idealized logical structure, relativized to context.

To get a general feeling for the character of strategies of inquiry, consider the following example from Asher and Lascarides (1998a):

- (1) a. A: I need to catch the 1:20 to Philadelphia.
- b. Where's it leaving from?
- c. B: Platform 7.
- d. A: Where do I get a ticket?
- e. B: From the booth at the far right end of the hall.

Informally, (11) gives the update dynamics of the discourse context in (10). At each stage, the context is a four-tuple, consisting of the set of discourse referents known by the interlocutors; the set of recognized domain goals; the set of questions under discussion (QUD), i.e. the accepted discourse goals; and the common ground (CG) of the interlocutors, a set of propositions. Propositions and questions are represented by material in italics; it should be borne in mind that these are actually sets of possible situations and sets of sets of possible situations, respectively, and not sentences of English or representations of such; that is, propositions and questions are informational entities.

- (2) Dynamics of the Context for Discourse (10):

Input context *C*:

Discourse Referents:	empty of relevant entities
Domain Goals:	empty
QUD:	empty (nothing under discussion)
CG:	empty except for general world knowledge among strangers, including the information that to catch a train one needs to know where it leaves from and where to get a ticket for it

C+(10a):

Discourse Referents:	{ <i>x</i> =1:20 train to Philadelphia}
Domain Goals:	{A catches <i>x</i> }

- QUD: <how does one catch x?>
 CG: general world knowledge among strangers + {A needs to catch x}
- (C+(10a))+(10b):
 Discourse Referents: {x=1:20 train to Philadelphia}
 Domain Goals: {A catches x}
 QUD: <how does one catch x?, where is x leaving from?>
 CG: general world knowledge among strangers + {A needs to catch x, A inquired about where x is leaving from}
- ((C+(10a))+(10b))+(10c):
 Discourse Referents: {x=1:20 train to Philadelphia. y=platform 7}
 Domain Goals: {A catches x}
 QUD: <how does one catch x?>
 CG: general world knowledge among strangers + {A needs to catch x, A inquired about where x is leaving from, B asserted that x leaves from platform 7, x leaves from platform 7}
- (((C+(10a))+(10b))+(10c))+(10d):
 Discourse Referents: {x=1:20 train to Philadelphia. y=platform 7, z=ticket for x}
 Domain Goals: {A catches x}
 QUD: <how does one catch x?, where does A get z?>
 CG: general world knowledge among strangers + {A needs to catch x, A inquired about where x is leaving from, B asserted that x leaves from platform 7, x leaves from platform 7, A inquired about where to get z}
- (((((C+(10a))+(10b))+(10c))+(10d))+(10e):
 Discourse Referents: {x=1:20 train to Philadelphia. y=platform 7, z=ticket for x, u=the hall, w=booth at far right end of u}
 Domain Goals: {A catches x}
 QUD: empty
 CG: general world knowledge among strangers + {A needs to catch x, A inquired about where x is leaving from, B asserted that x leaves from platform 7, x leaves from platform 7, A inquired about where to get z, B asserted that A could get z at w, A can get z at w, A knows how to catch x}

At the outset, the interlocutors share little relevant information. A's utterance of (10a) is an assertion, and unless B objects, it is added to the CG; the train itself simultaneously becomes a familiar and salient discourse referent. It is also clear from the content of (10a) (via the meaning of *need*) that it expresses a goal for A, and unless B objects or otherwise shows herself unhelpful, cooperative principles lead to the addition of that goal to the set of domain goals of the interlocutors. Henceforth, in order to be Relevant to the established domain goal, subsequent discourse must attempt to further it, directly or indirectly; this is reflected in the addition to the set of questions under discussion QUD of the question of how to catch the train. (10b) poses a question which is Relevant in that it seeks information required to catch the train, hence that it

represents a discourse goal that is part of a strategy to achieve the established domain goal. Given world knowledge about how to catch a train, this new question is a sub-question of the question already on the QUD stack, since knowing how to catch the train entails knowing where to get it. Again, unless B objects, the question is added to the stack of questions under discussion. B's reply in (10c) counts as a complete answer to the question at the top of the QUD stack, and so that question is removed from the stack when the answer is added to the CG, along with the discourse referent for platform 7. Once B in (10c) has resolved the first question, A initiates the next phase of his overall strategy to achieve the domain goal, the discourse goal corresponding to the question in (10d). The treatment of this question/answer pair is parallel in treatment to that in (10b)/(10c). At the end, the information in CG entails knowing how to catch the train, so the first question is also removed from the QUD, and the issues under discussion are resolved.

Not all discourses involve explicit questions under discussion, but all can be shown to address implicit questions, capturing the intuitive notion of topics under discussion. For example, consider examples (12)-(15) from Mann and Thompson (1986), illustrating various types of rhetorical relations in their Rhetorical Structures Theory:

- (3) a. I'm hungry
b. Let's go to the Fuji Gardens.
- (4) a. We don't want orange juice.
b. We want apple juice.
- (5) a. I love to collect classic automobiles.
b. My favorite car is my 1899 Duryea.
- (6) a. Go jogging with me this afternoon.
b. You'll be full of energy.

The assertion in (12a) pertains to a particularly important human imperative, and hence suggests a domain goal, satisfying the speaker's hunger. As usual, suggesting a domain goal raises a corresponding topic for conversation—how to satisfy that goal. (12b) then suggests an answer to that implicit question, going to eat at a particular restaurant. Mann & Thompson give this as an example of the rhetorical relation of *Solutionhood*, since the second utterance proposes a solution to the problem posed by the first. This characterization is perfectly compatible with the intentional analysis just suggested.

(13) is an example of the rhetorical relation Mann & Thompson call *Contrast*. Note that this contrast would be reflected in utterance of this discourse by placing narrow prosodic Focus on the direct object of *want* in each clause. Roberts (1996a) proposes a general theory of Focus interpretation in which the focal structure of an utterance presupposes the type of question it may address.² Here, the narrow focus on each utterance would presuppose that they address the question of what the speaker and other individual(s) want. If that (probably implicit) question

² See Roberts (1998b) for application of the theory to the comparative analysis of Hungarian and English, Kadmon (2000) for comparison of this general approach to Focus with others in the contemporary literature.

were't Relevant in the preceding discourse, then utterance of (13) would be infelicitous, as in reply to *Where are you two going today?*. While it seems correct to characterize this pair of utterances as standing in contrast, by itself this fails to predict the kinds of contexts in which they would be felicitously uttered. But by looking at the discourse fragment with a view to the presupposed question under discussion, we capture both the contrast and felicity.

(14) illustrates the rhetorical relation Mann & Thompson call *Elaboration/set-member*. Again, there is no explicit question under discussion in this discourse fragment. But these utterances would be relevant to a question such as *What are your hobbies?*, or the like. If that were the question under discussion, (14a) would be a (possibly only partial) answer. The elaboration in (14b) would be warranted on the assumption by the speaker that the question was part of a larger strategy to find out what the speaker is like, what he likes and dislikes, etc. If this were the case, then (14b) would be more helpful than the direct answer in (14a) alone, and in keeping with Planning theory generally, a cooperative interlocutor attempts to get at what the query is really after, rather than offering only the information literally requested.

(15) is of interest because the first utterance is an imperative, rather than a question or assertion. Imperatives propose a domain goal to the addressee, that of bringing it about that the proposition expressed by the corresponding indicative with the addressee as subject is true. So (15a) proposes that the addressee make it true that she jogs with the speaker on the afternoon in question. Whether or not the addressee accepts the proposed goal corresponding to an imperative depends on many things, including the relative power of speaker and addressee, degree of cooperativeness, reasonableness of the request, etc. In a situation in which the speaker has little power to force the adoption of the goal, she may attempt to motivate the addressee to accept it by giving reasons why its adoption and achievement are desirable for the addressee, i.e., by addressing the potential question *Why should I?*. (15b) is relevant to (15a) by virtue of addressing this question of why the addressee should adopt the goal suggested by (15a). This understanding is triggered by the need both to determine the Relevance of (15b) and to resolve the presupposition of a reference time for interpretation of the future tense: If the addressee *does* accept the proposal and go jogging, 'after you do, you'll be full of energy'. This account in terms of Relevance and questions under discussion is compatible with Mann & Thompson's characterization of this discourse fragment as illustrating the Rhetorical relation of *Motivation*. And their rhetorical relations more generally can be seen as types of strategies for pursuing goals in discourse.

Hence, Relevance, Focus and other presuppositions can be used to retrieve questions under discussion which are only implicit, never explicitly asked. It illustrates a prevalent feature of the language gameplan, which is modelled more abstractly in Planning Theory via Plan Inferencing Rules that permit us to infer interlocutors' plans from other information in the common ground plus what is actually said. Similarly, sometimes answers which are obviously entailed in a given context are not explicitly uttered, but are nonetheless entered into the **common** ground. These cases involve *accommodation*, in the sense of Lewis (1979), and are quite normal in discourse: If it is clear that an interlocutor presupposes a question or assertion ϕ which is not yet commonly agreed upon, then if the interlocutors have no objection they behave as if the common ground contained ϕ all along. Hence, the notion of a move in a discourse game is essentially semantic. A question is not necessarily realized by a speech act, but is only a question-denotation in the

technical sense, a set of relevant alternatives which the interlocutors commit themselves to addressing. It tells you what the discourse is "about" at that point in the discourse, and further, if we look at the strategy of questions in which it participates, it tells us where the discourse is going.

C. An approach out of Planning Theory

Planning Theory arises in Artificial Intelligence, in the study of how agents, often in collaboration, plan and execute complex tasks, generally using abduction as a means of doing practical reasoning, especially in inferring a cooperating agent's plans. Thomason, Stone & DeVault (2006) apply Planning Theory to discourse. This is a brief précis of what they offer, which is closely related to proposal here (in turn partly inspired by the earlier work of Thomason 1990). My own comments are in square brackets:

Background assumptions:

- "intention [is] a complex mental attitude that summarizes an agent's reason to act" (citing work from Artificial Intelligence, e.g. Bratman 1987, Pollack 1990, Pollack 1992)
 - functions in rational agency to help agents:
 - manage problem solving in planning
 - cope with obstacles and opportunities that arise in a dynamic world
 - understand why actions fail and how to respond when they do
 - work more effectively together
 - as information structures, they also:
 - delineate the real-world circumstances that the agent is committed to
 - characterize the action that the agent undertakes
 - explain, in the context of the agent's theory of the world, why taking that action in those circumstances will lead to an outcome that the agent wants
- "mutuality of information is decisive in pragmatic reasoning"
 - The adoption of an ideally rational, conventional signaling system requires mutual knowledge (Lewis 1969). They criticize Sperber & Wilson's (1985) rejection of mutual belief (p.11). Correspondingly, "a distinction between given and new information is important in understanding many linguistic phenomena" which involves mutuality (Clark & Marshall 1981), but in the iterations involved in defining mutuality, "common sense-reasoning tends to break down". For an account of mutuality in terms of default suppositions, see Thomason 2000.

Principles:

- (1) In conversations, speakers must formulate, and listeners must infer, an interpretation for each utterance that is uniquely recognizable from the form of the utterance, using mutually-supposed [and recognizable] background information. [cf. Retrievalability]
- (2) Interpretations outline a speaker's commitment not just to the content of a specific contribution to conversation, but also to the underlying intention, and through this to the structure of the utterance (as analyzed by the grammar) and to the relevant extralinguistic facts that link grammatical meaning to conversational content.
 - including commitment to preconditions of the utterances, apposite commitments about the conversational situation [e.g. to (pre)suppositions and through prosodic Focus, to the QUD]

Hypotheses:

❖ conversation as collaboration

Hence, “mutuality of information is decisive in pragmatic reasoning”.

❖ interpretation as intention recognition; see Principle (2)

Thomason 1990 (16):

To mean p is to intentionally reveal an intention to make p asserted through the hearer’s recognition of the status of an intention or plan of the speaker’s.

“I am not denying that the reflections and convolutions of Grice’s definition are part of the subject matter, but the idea is to locate them elsewhere. In particular, on the approach that I am trying to develop they are concealed in the mutuality of the conversational record.” (16)

abductive, hence feeds both plan formation and recognition; so provides a unified architecture for generation and interpretation (see Hobbs, Stickel, Appelt & Martin 1993 on the role of abduction (inference to the best explanation) in interpretation; and Stone & Thomason 2002 on how interpretation involves, inference from the fact of the utterance to the speaker’s communicative intention in making that utterance)

Thomason 1990: Update to the conversational record involves default reasoning, especially “[W]henver an intention to assert p is recognized, the record is updated with p .”

intentions as complex informational states, consisting of:

1. a goal
2. a plan
3. preconditions

In discourse, these = speaker presuppositions/utterance presuppositions

Crucially, these are not necessarily given prior to utterance:

“While we acknowledge that speakers will track the common ground to ensure their intentions are recognized—clearly an intention that cannot be recognized is flawed—we do not go the further step of assuming that the speaker must take these preconditions to be part of the common ground.” (11)

“Regarding the role of presupposition in collaborative planning domains, we want to suggest that presuppositions correlate with tacit actions to which the intention behind the utterance is committed. They do this by adjusting preferences for interpretations so that explanations that associate the content of the presupposition with tacit actions are less costly. For instance, the declarative content of *When the water boils, you will blanch the tomatoes* is that H will blanch T when W boils; its interpretive force is a preference for intentions that commit to having performed actions that create the preconditions for W boiling.” (40)

❖ context: “we take each state to specify an abstract, objective body of information that constitutes the conversational situation—the information state (IS) of the conversation (Poesio & Traum, 1997; Larsson & Traum 2000)” including:

- sets of propositions contributed to the conversational record (Stalnaker 1981) [CG]
cf. Thomason 1990: the Conversational Record is evidence for plan recognition [hence for retrieving meaning_{nn}]
- plans and problem-solving activities that are underway (Lochbaum 1998) [QUD]
cf. Thomason (1990:13): “plan recognition is as important for understanding implicature as deduction is for understanding validity.”
- outstanding interlocutor obligations (Traum & Allen 1994) [ToDo lists]
- linguistic forms of prior utterances (Purver 2004) [fades fast]
- etc. [discourse referents, pov, etc.: other scoreboard elements]

❖ accommodation as enlightened update

accommodation: the conversation moves forward “not just through the positive effects of interlocutors’ utterances but from the retrospective insight interlocutors gain about one another’s mental states from observing what they do.” (p.1)

cf. Thomason 1990: Accommodation involves plan recognition plus cooperative goal adoption, and is thus a special case of collaborative obstacle elimination.

“accommodation can be a natural and transparent adjustment to the state of the conversation. In effect, accommodation makes sure that an utterance IS acceptable in the context in which it is interpreted...[therefore] an unreflective and inevitable side-effect of interpretation” (p.30) [Stalnaker 1998, von Stechow 2000 agree with the naturalness and inevitability of accommodation] use of “enlightened update” avoids treating presupposition in terms of “repair strategies arising from the violation of a rule (Lewis 1979) or in terms of pretense (Clark 1992) or in terms of sequential updates of the common ground” (von Stechow 2000) (p.12). Presupposition is too “common and routine” for the first two, and the last is not independently motivated by other pragmatic reasoning considerations, so seems ad hoc.

- ❖ pragmatic reasoning is holistic in character, continuous with common-sense reasoning about collaborative activities
 - favors unifying explanations [cf. Roberts’ 2011 simultaneous solutions]
 - An interpreter must find the best overall explanation of the utterance, using pragmatic reasoning to resolve ambiguity and anaphora, satisfy presuppositions, etc. Hence, “presupposition resolution can’t be an isolated subsystem but must interact with other sources of alternative interpretations.” (p.30)

Next up: Focus, Alternatives and Prosodic Congruence

References:

For a map of issues and relevant literature to date, see Appendix A of Roberts (1996/2012):

<http://www.ling.ohio-state.edu/~croberts/QUDbib/>

- Bar-Hillel, Yehoshua (1971) *Pragmatics of Natural Language*. Dordrecht: Reidel.
- Büring, Daniel (2003) On D-Trees, Beans, and B-Accents. *Linguistics and Philosophy* 26(5):511-545.
- Clark, Herbert H. (1996) *Using Language*. Cambridge University Press.
- Ginzburg, Jonathan (1996) Dynamics and the Semantics of Dialogue. In Jerry Seligman & Dag Westerstahl (eds) *Language, Logic and Computation*. Stanford, CA: CSLI.
- Ginzburg, Jonathan (2010) *The Interactive Stance: Meaning for Conversation* (under review with Oxford University Press)
- Grice, H. Paul (1957) Meaning. *The Philosophical Review* 66. Reprinted in Grice (1989) *Studies in the Way of Words*, Harvard University Press, pp.213-223.
- Groenendijk, Jeroen & Martin Stokhof (1984) *Studies in the Semantics of Questions and the Pragmatics of Answers*. Ph.D. dissertation, University of Amsterdam.
- Groenendijk, Jeroen & Martin Stokhof (1997) Questions. In Johan van Benthem & Alice ter Meulen (eds.) *Handbook of Logic and Language*, Elsevier Science/MIT Press, Chapter 19, 1055-1124.
- Hamblin, C. (1973) Questions in Montague English. *Foundations of Language* 10:41-53. Reprinted in Barbara Partee (ed.) (1976) *Montague Grammar*, University of Texas Press.
- Heim, Irene (1982) *The Semantics of Definite and Indefinite Noun Phrases*. Ph.D. dissertation, University of Massachusetts, Amherst.
- Kamp, Hans (1981) A Theory of Truth and Semantic Representation. In Jeroen Groenendijk, Theo M. V. Janssen and Martin Stokhof (eds.) *Formal Methods in the Study of Language*, 36 Vol. I, Mathematische Centrum, Amsterdam. Reprinted in Groenendijk, Janssen and Stokhof (eds.), 1984, *Truth, Interpretation and Information*. Foris, Dordrecht.
- Kaplan, David (1977) Demonstratives, draft #2. Ms., UCLA Philosophy Department. Revised as: *Demonstratives: An essay on the semantics, logic, metaphysics, and epistemology of*

- demonstratives and other indexicals. In Joseph Almog, John Perry & Howard Wettstein (eds.) *Themes from Kaplan*. Oxford University Press, 1989, pp.481-563.
- Karttunen, Lauri (1977) Syntax and semantics of questions. *Linguistics and Philosophy* 1:3-44.
- Lewis, David (1970) General semantics. *Synthese* 22:18-67.
- Lewis, David (1979) Scorekeeping in a language game. In R. Bäuerle, U. Egli, and A. von Stechow (eds.) *Semantics from a Different Point of View*. Springer, Berlin.
- Roberts, Craige (1996/2012) Information Structure in Discourse: Towards an Integrated Formal Theory of Pragmatics. In Jae Hak Yoon and Andreas Kathol (eds.) *Ohio State University Working Papers in Linguistics* Volume 49. Reprinted in the 1998 version with a new Afterword in *Semantics and Pragmatics*, Volume 5, 2012.
- Roberts, Craige (2011) Solving for interpretation. Ms., OSU.
- Sperber, D. and D. Wilson (1986) *Relevance: Communication and Cognition*. Harvard University Press, Cambridge, MA.
- Stalnaker, Robert (1979) Assertion. In Peter Cole (ed.) *Syntax and Semantics* 9.
- Thomason, Richmond (1990) Accommodation, meaning, and implicature: Interdisciplinary foundations for pragmatics. In P. Cohen, J. Morgan, and M. Pollack (eds.) *Intentions in Communication*. MIT Press, Cambridge, MA.
- Thomason, Richmond H., Matthew Stone & David DeVault (2006) Enlightened Update: A computational architecture for presupposition and other pragmatic phenomena. Ms., University of Michigan, Rutgers University, University of Edinburgh. Talk at the NSF-sponsored Workshop on Accommodation, OSU.