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Context in Dynamic Interpretation

1. Context, Semantics, and Pragmatics

The linguistic subfields of semantics and pragmatics are both concerned with the study of meaning. We might say that semantics studies what Grice (1967) called the TIMELESS MEANING of a linguistic expression ϕ —the basic meanings of the words in ϕ composed as a function of the syntactic structure of ϕ . Formal semantics, especially since the seminal work of Montague (1973), attempts to develop an empirically adequate theory of semantics for a given language by developing rules that are clear and unambiguous in their application and effect, and in so doing, makes clear predictions about the possible meanings for a given expression. Semanticists assume that words do have basic meanings, and that a given syntactic structure corresponds with a determinate way of composing the meanings of its subparts.¹ Pragmatics, on the other hand, studies utterances of expressions like ϕ , attempting to explain WHAT SOMEONE MEANT BY SAYING ϕ ON A PARTICULAR OCCASION. It is clear that there is quite often a difference between the timeless meaning of ϕ and what someone meant by uttering ϕ on a given occasion. It is a truism among native speakers that this difference arises because of the way that the context of utterance influences interpretation. We complain if someone quotes what we say out of context because this may well distort our intended meaning. But what is a context of utterance, and how does it influence interpretation?

A linguistic interchange is generally called a discourse, hence the problem of understanding contextual influences on interpretation is often stated in terms of the role of discourse context in interpretation. There are three general senses in which the notion of context is understood in the literature on semantics, pragmatics, and discourse. The first of these senses is as the actual discourse event, a verbal exchange (even if only a monologue). This is associated with a very concrete situation including the speaker and addressee(s), the actual sound waves, a physical locale, and things pointed out (e.g., Barwise & Perry 1983). The second sense is as the linguistic content of the verbal exchange—what's actually said. This may be characterized as a linguistic string under a syntactic analysis, with associated syntactic and prosodic structures, but more often it is represented as simple text (see Carlson 1983, Van Dijk 1985). The third sense is as a more abstract semantic notion, that of the structure of the information that is presupposed and/or conveyed by the interlocutors in such an exchange. These three ways of characterizing discourse context—as an event revolving around verbal exchange, as the linguistic content of that exchange, and as the structure of the information involved—are not mutually exclusive; there is no verbal exchange without linguistic content, and the linguistic content itself can be taken as one aspect of the abstract information structure of the exchange. Researchers approaching the problem from different directions, however, tend to focus on one or another of these to the exclusion of the others. Those who are interested in semantics from a truth conditional perspective (or something closely akin to that) tend to take the meaning of an utterance to be the information it conveys about the way the world is. In this case, it is convenient to characterize the context in which an utterance is made in terms of information that is structured in conventionally-given ways, and to study how that information structure interacts with the information contributed by the utterance itself to efficiently convey the intended meaning.

For example, Lewis (1979) uses the metaphor of a baseball scoreboard to characterize in a very general way how context interacts with the content of an utterance in "a language game". As in a baseball game, there are different facets of the "score"; that is, the information shared by interlocutors is articulated into different sorts, with different functions in the game. Lewis differentiates, among other things, between the set of presupposed propositions at a point in the conversation, the ranking of relative degrees of salience of entities under discussion at that point, and the current plans of the interlocutors. While the propositional information would play a clear role in satisfying, say, factive presuppositions, the ranked salient entities might play a role in resolving anaphoric reference, and an interlocutor's global plans would plausibly play a role in understanding her local intention to perform a certain type of speech act. Organizing information in this rather abstract way makes it possible to say more clearly exactly what kind of information plays a particular role in interpretation. If we include in the score information about the actual situation of utterance and (at least temporarily) the form and sequence of the utterances themselves,

then context so-conceived includes information about the two other notions of context. With this in mind, we will focus here on context as an abstract, structured object.

But what kinds of information does a context include, and how are these organized? In addressing this question I will adopt the strategy suggested for semantics by Lewis (1972):² In order to say what a context of utterance *is*, we will first ask what a context *does* in the course of semantic interpretation, and then find something that does that, and does it in a way that comports well with our semantic theory. A pragmatic theory that approaches the rigor and predictive power of formal semantics would presuppose a theory of the linguistic structures (syntactic, morphological, prosodic) of an utterance. And it would include both a well-defined notion of linguistic context and a specification of how structure and context interact with semantic rules to yield the attested felicity of and interpretations for particular utterances. Such a theory would be capable in principle of making clear predictions about the meanings conveyed by utterances in particular contexts.

In the following section, we will consider what it is that context does to interact with semantic interpretation. In Section 3, we will consider the influential development within formal semantics of theories of dynamic interpretation, which involve a more sophisticated view of context and its role in interpretation than in earlier work. In Section 4, we will consider how such theories are currently being extended to account for a wider range of pragmatic phenomena. Section 5 presents some general conclusions.

2. What Context Does: Felicity and Context Update

Context interacts with the semantic content of an utterance during the course of interpretation in two fundamental ways: It is crucial in determining the proposition (or question, or command, etc.) that a speaker intended to express by a particular utterance, and it is in turn updated with the information conveyed by each successive utterance. The first role—the context-dependence of interpretation—is most obvious when phenomena like anaphora, ellipsis, and deixis are involved. When these occur in an utterance, its semantic interpretation is essentially incomplete, and the intended truth conditions can only be determined on the basis of contextual clues. These phenomena are all-pervasive in linguistic interpretation. Consider, for example, how we interpret tense. In a language like English, past tense is interpreted relative to a (presumed) time of speech, and hence is indexical, while in a language like Korean (see Yoon 1996) past tense in an embedded clause is interpreted relative to the event time of the main clause, and so is anaphoric.

The phenomenon of context-dependence can be conceived more broadly in terms of felicity. The aptness of an utterance depends on its expressing a proposition that one could take to be reasonable and relevant in the context of utterance. What this means in practice is that we have to look at the context to determine what was expressed, either because it was inherently incomplete, as with anaphora or ellipsis, or because its *prima facie* interpretation would appear to be irrelevant or otherwise infelicitous. Felicity in this sense has many reflexes. For example, knowledge of the context of utterance is crucial in figuring out which speech act a speaker intends to perform by the utterance of an imperative like *Hand me the rope*. Only by considering the relative status of the interlocutors in the situation in question and the information they share about where the rope is, whether the speaker needs or wants it, and what's to be done with it, can we form a hypothesis about whether this constitutes a request, a command, permission, or advice to the hearer to hand the rope to the speaker. Otherwise, we cannot say what type of obligation the speaker urges the hearer to undertake, and hence, we cannot understand the sense of the imperative.

Another reflex of felicity is the determination of intended reference, including anaphora resolution and deixis. Reference problems tied to context are quite often more subtle than these paradigmatic reference problems, however, and may be encountered in non-pronominals as well, as illustrated by the following:

- (1) Please hand me some lilacs. (inspired by Wagner 2000)

If (1) is uttered in a florist shop, we are likely to take *some lilacs* to refer to the reproductive organs of plants cut for decorative use. But if the addressee is standing by a row of containers filled with silk flowers, with no organic flowers in view, the reference of *lilacs* will generally be extended to include artificial lilacs. These two kinds of referential problems—anaphora and contextual suitability of

reference—are often combined in definite descriptions, as pointed out by Nunberg (1977; see also Nunberg this volume). We see this in the following discourse inspired by his examples:

- (2) A: Where's the ham sandwich?
B: He's sitting at table 20.

A definite description is generally taken to presuppose existence of some entity that is unique in satisfying the NP's descriptive content, and it has been argued, moreover, that this entity is presupposed to be familiar to the interlocutors.³ Carrying a presupposition puts a requirement on the context in which the relevant NP can be felicitously uttered. As in other cases involving definite descriptions, utterance A in (2) will only express a felicitous question when the context entails that there is a unique ham sandwich in the situation under discussion, which is familiar to the interlocutors.⁴ If A is uttered in a kitchen, five minutes after one of the interlocutors has prepared an actual ham sandwich in full view of the other, *the ham sandwich* will be taken to refer to the one recently prepared. But uttered by a waitress standing at the kitchen door holding a ham sandwich and scanning the house, the reference of *the ham sandwich* will more likely be shifted to refer to the person who ordered the sandwich she's holding. In this context, someone might answer A with B. Since ham sandwiches cannot generally be referred to with masculine pronouns, the familiarity presupposition associated with *he* will fail unless the meaning of the definite description (via the meaning of the head noun *ham sandwich*) has been shifted from the more literal denotation to the associated male customer. This would lead the cooperative hearer to make the shift, guaranteeing that the utterance will be felicitous, taken to mean that the person who ordered the ham sandwich is at table 20.

Beyond reference and anaphora, interlocutors look to the context for the resolution of any presuppositions conventionally triggered by lexical items or constructions in an utterance.⁵ Like pronominal anaphora, other sorts of presuppositions are often radically indeterminate, as we see with *too*:

- (3) [_{Foc} I] ordered a ham sandwich, too.

The presupposition associated with *too* is determined by searching the context for a proposition just like that expressed by the clause to which it is adjoined except that some other individual is substituted for the focused constituent in that clause. Here, this would be a proposition of the form *x ordered a ham sandwich*, where *x* is some individual other than the speaker of (3). In the restaurant context, this might be the proposition that the fellow at table 20 ordered a ham sandwich, a proposition implied by the discourse in (2). Other types of presuppositions, e.g., factives, are more like definite descriptions in having a fairly rich descriptive content. That is, they are sufficiently explicit that if they initially fail in the context of utterance, what is presupposed can often be reconstructed and hence, if the interlocutor is cooperative, accommodated (in the sense of Lewis 1979). But when interlocutors cannot resolve such context-dependent elements of an utterance, as an out of the blue utterance of (3), it is impossible to determine the proposition that the speaker intended to express.⁶ Thus in the general case, presupposition failure—the inability to resolve the speaker's intended presupposition—results in a lack of truth value for the utterance.

Besides felicity, the other way in which an utterance interacts with its context in the course of interpretation is by leading to the update of that context. For one thing, when someone utters one of the examples cited above, the fact of that utterance is added to the information contextually available to those who have heard it. Moreover, the content of the utterance itself may make a contribution. After the utterance of (1), unless the addressee rejects the speaker's implicit claim on her cooperation she will be committed to handing him some of the relevant lilacs. Similarly, if those the speaker addresses in asking (2A) tacitly agree to accept her question for discussion, that acceptance influences what will constitute felicitous contributions in the succeeding context: Cooperative interlocutors generally attempt to address the questions already posed before changing the subject. Hence, unless (2A) is rejected, saying something that doesn't address it would generally be taken as infelicitous or rude until the question has been answered. And in (2B) or (3), if the identity of the intended presupposition is contextually resolved, and the addressees (implicitly) accept its truth, then that proposition is added to their common information. In this way, requests or commands, questions, and assertions can contribute toward satisfying the presuppositions of subsequent utterances, hence making them felicitous. They may, for example, provide antecedents for anaphora.

I conjecture that all pragmatic phenomena pertain to one or both of the two ways of interacting with context just discussed—contextual felicity or context update. If this is the case, any of the phenomena

that hinge on felicity would place requirements on the types of information that context should provide in order to determine felicity. For example, deixis involves resolving the presuppositions of the deictic linguistic element—a word, tense, etc.; checking for felicitous use requires that the context provide information about the perceived environment of utterance, in particular, about what is being indicated by the speaker at the time of utterance. If we assume that the resolution of deixis is one aspect of contextual felicity, then we must assume that the context of interpretation contains not only information conveyed by the linguistic text of the discourse, but also about the physical situation of utterance (see Roberts 2002). Another central problem in pragmatic analysis is Gricean conversational implicature. Several authors have argued that such implicatures may be explained as contextual entailments.⁷ For example, if an utterance is *prima facie* irrelevant, then a metapresupposition of relevance and reasonable assumptions about the speaker's goals and intentions would lead us to infer that she meant more than she said. Felicity then drives the update of the context with the intended meaning over and above the proposition literally expressed. In order for this type of account to work, context would need to reflect the fact that the interlocutors are committed to something like the Gricean maxims, as well as containing information about the interlocutors' goals and intentions.

Further, Grice's maxims can be seen as instances of a larger set of conventions—or metapresuppositions—governing the flow of information-exchange in discourse. Just as one's utterances should be clear, unambiguous, and relevant to the topic under discussion and should contain the appropriate amount of information for the purposes of the interlocutors' current goals, in the interests of an orderly exchange we observe various conversational turn-taking conventions.⁸ These can also be regarded as metapresuppositions about the well-formedness of the unfolding discourse. Hence, if someone fails to yield the floor at the appropriate point or overlaps with the speech of the interlocutor who has the floor, their contribution is as much in violation of the rules of discourse as a failed presupposition. The motivations for these different types of conventions, as well as the consequences of their violation, are different in character. The failure to resolve a presupposition leaves the interlocutors without an understanding of the proposition expressed, whereas overlapping with the speaker is more likely to irritate than to confuse. In both cases, however, the problem lies in a failure to make one's contributions accord with the evolving structure of the discourse context in such a way as to be maximally cooperative, as defined by the various sorts of conventions governing linguistic discourse. In order to capture these constraints on felicity, context has to encode the rules of conversational turn-taking as well.

Another set of issues in pragmatics concerns matters of prominence and salience in discourse. Topic and Focus have often been argued to revolve around presuppositions about what was under discussion in the previous discourse, so that again, the same notion of felicity can be argued to underlie the acceptability of, say, focus placement in the standard question/answer paradigm⁹ or topicalization.¹⁰ We would expect, then, that context would tell us what was under discussion in the relevant respects so that we could use that knowledge to determine whether a particular Focus or Topic is felicitous. Similarly, Centering Theory attempts to capture what it is that makes certain potential pronominal antecedents more salient than others in a given discourse; again, it might be said that pronouns carry a presupposition of the salience of their antecedents, with salience taken to be a property of the context of utterance.¹¹ It seems clear, then, that the context needs to contain information about what is salient at any given point in the discourse.

Summarizing, what a context seems to do is to store various kinds of information shared in discourse. This information is used to determine felicity in discourse, and is, in turn, updated with the contributions of succeeding utterances. Several types of information have been mentioned here. There is propositional information, relevant for factive presuppositions and the like. There is information about the issues, or questions, under discussion, about the entities under discussion, and about the relative salience of these questions and entities, *inter alia*, all relevant for presupposition, Focus, Topic, and anaphora resolution. The context should also encode in some form various metaprinciples governing cooperative interchange, including something like the Gricean maxims and the principles of conversational turn-taking. But there is one more constraint on context that has been the subject of considerable interest in the formal semantics community over the past two decades: The information in the discourse context should be encoded so as to capture all the logical constraints on interpretation that have been explored in formal semantics, including entailments, the scope of operators and their potential for binding free pronominals and other variable-like elements, and a requirement on overall logical consistency. It is from the wedding of these logical constraints with the types of pragmatic factors just discussed that theories of dynamic interpretation were born.

3. Dynamic Theories of Interpretation

Context in the theories of semanticists who followed the general approach of Montague was captured as a set of indices, or contextual parameters, attached to the interpretive apparatus for a given sentence. These were pointers to specified sorts of contextual information, utilized to feed the relevant information into the process of compositional interpretation that yielded the proposition expressed by the sentence in the specified context. This limited set of indices typically included the world and time of utterance (a way of capturing the facts about the utterance situation, as well as interpreting tenses and utterances of words like *now*), the speaker and sometimes the addressee (for *I, we, you*, etc.), the location of the utterance (e.g., for the interpretation of *here* or *local*), and a function assigning values to free variables (the logical form counterparts of pronouns and other pro-forms). Additional indices were sometimes posited for elements like indicated objects (for deixis accompanying *this* and *that*), or even the relative status of the interlocutors (e.g., for Japanese honorifics or French *tu* vs. *vous*) and the level of formality of the discourse. However, it isn't clear that one could in principle specify a finite set of indices of this type that would be adequate for all the types of information relevant for capturing pragmatic influences on interpretation. Moreover, in the interpretation of a given utterance the values given by these indices were arbitrarily selected, without any mechanism for keeping track across the larger discourse of what was being talked about and how this might bear on the interpretation of utterances in that discourse. Finally, the notion of context in such theories was static, leaving no provision for capturing how interpretation of the first part of an utterance might influence the interpretation of the rest.

It was particular problems in anaphora resolution and the interpretation of tenses that inspired the early work on what is now called **dynamic interpretation**. Heim (1982) and Kamp (1981) focused on the so-called donkey sentences of Geach (1967), illustrated by the following:

- (4) If a farmer owns a donkey, he always uses it to plow his fields.
- (5) Most farmers that own a donkey use it to plow their fields.

Deceptively simple, these examples are semantically interesting because they show that the way we keep track of information across discourse, including possible anaphoric referents, must be sensitive to the presence of quantificational operators, here *always* and *most*, and also that context must be updated sentence-internally. To see this, first note that the indefinite NP antecedent of *it* in both sentences occurs within a subordinate clause which serves to restrict the domain of a quantificational operator, *always* or *most*. For example, in (4) we are not making a claim about just any kind of situation, but only about those in which there is a farmer and a donkey he owns. And in (5), we're making a claim about the proportion of individuals involved in plowing their fields, but the class of individual involved doesn't include all farmers, only those who own a donkey. But if we replace *a donkey* with a clearly quantificational NP like *every donkey*, the pronoun *it* becomes infelicitous, showing that the anaphoric relation in question isn't binding, and must instead be anaphora to some salient entity in prior discourse. But the antecedent in these examples, the indefinite *a donkey*, occurs in the same sentence, showing that if pronouns presuppose a familiar entity from prior discourse context as antecedent, discourse context must be updated in an on-going way even in the course of interpreting a single utterance. Moreover, although these examples show that the indefinite can serve as antecedent of a pronoun under the scope of the operator, the indefinite ceases to be accessible to pronouns in subsequent discourse. So, neither (4) nor (5) can be felicitously followed by (6):

- (6) It had to be fed extra grain during plowing season last spring.

The central feature of the theories proposed to account for such examples is that utterances are no longer interpreted in isolation. Instead, the meaning of an utterance is treated as a function from contexts (each one a possible context of utterance) to contexts (the contexts resulting from updating the context of utterance with the content of the utterance). Heim called this the utterance's **CONTEXT CHANGE POTENTIAL**. This notion of meaning is dynamic in that it changes continuously during interpretation. For example, the interpretation of utterances like (4) and (5) takes place in stages, corresponding in some respects to the two-sentence discourse in (7):

- (7) a. A farmer owns a donkey.
 b. He uses it to plow his fields.

Interpreting (7) in a context C , we first update C with the information contributed by the utterance of (7a), as in (8):

- (8) Input context C :
 Propositional information shared by the interlocutors, including the proposition that a speaker S is speaking.
 A set of familiar entities, the discourse referents.
 Output context $C+(7a)$:
 The propositional information in C plus the proposition that S uttered (7a) in C and (assuming no one questions S 's trustworthiness) the information that there is a farmer who owns a donkey.
 The set of discourse referents in C plus one for the farmer and one for the donkey.

We do much the same in the first stage of interpretation of (4) and (5), so that the initial context is first updated with the information in the subordinate adverbial clause or subject NP with its relative clause. We interpret (7b) taking the context of utterance to be $C+(7a)$, the update of C with the information conveyed by (7a); after considering the gender of the pronouns we reasonably take the salient farmer to be the antecedent of *he* and the salient donkey owned by the farmer to be the antecedent of *it*. Just so, in the remainder of (4) and (5), we use the entities made salient by the first part to resolve the anaphora. But there is a difference. We can follow (7) with (6), i.e., the update of C with (7a) (and (7b) subsequently) is a permanent update, but in (4) and (5), because of the operators, the update pertaining to the donkey is only temporary. Though there is a permanent effect—ruling out the existence of farmers who own a donkey but doesn't use it to plow—there is no particular salient donkey after interpretation because the indefinite was used under the scope of an operator to allude to the properties of any arbitrary donkey standing in the requisite relation to a farmer.

Hence, theories of dynamic interpretation treat meanings as functions on context and utilize techniques developed in formal semantics to capture logical constraints on interpretation, including quantifier scoping and entailment. Contexts are considered by some theorists to be representations of the contextual information in question, as in Discourse Representation Theories (Kamp & Reyle 1993), and by others to be more abstract structured information, as in Context Change Semantics (Heim 1982, 1992) and Dynamic Montague Grammar (Groenendijk & Stokhof 1989).¹² Dynamic Montague Grammar puts greater emphasis on the retention of compositionality as a methodological principle in interpretation, whereas Discourse Representation Theory tends to dismiss compositionality as uninteresting for natural language. There are significant differences as well in the proposed treatments of anaphora in these theories¹³, but the general dynamic approach to the treatment of anaphora and several other types of pragmatic phenomena in discourse is now firmly established in the formal semantics tradition.

This approach offers a new dimension to the earlier characterization of an utterance in Bar-Hillel 1971 as an ordered pair consisting of a sentence and a context. On the dynamic view of interpretation, we might consider an utterance to be a pair consisting of a sentence under a linguistic analysis, e.g., its logical form, and an input context, the context just prior to utterance. Given that the logical form is conventionally correlated with a context change potential, this implies as well an output context, i.e., the value of the context change potential given the input context as argument. For example, (the logical form of) (7a) in the context C is an utterance, which results in the updated context $C+(7a)$ given in (8).

What kinds of information are in the context in a dynamic theory? Heim takes context to be an elaboration of Stalnaker's common ground (the set of propositions which the interlocutors in a discourse behave as if they all hold to be true, with a proposition realized technically as a set of possible worlds), including not only the set of propositions that the interlocutors hold in common to be true (each proposition a set of possible worlds), but also a set of DISCOURSE REFERENTS. A discourse referent is an abstract entity-under-discussion. Such an entity may or may not actually exist—we can talk about hypothetical entities, even nonexistent ones—but we keep track of the information about each such entity across discourse. Heim characterizes a discourse referent informally as a file card; technically, it is an index, corresponding to the referential index on the NPs used to refer to this entity in the discourse. Keeping track of discourse referents permits a theory of the interpretation of pronouns and definite NPs like *the ham sandwich* in

which such an NP carries a presupposition of familiarity to the interlocutors; that is, its utterance presupposes that there is a corresponding discourse referent in the input context of interpretation. Indefinites like *a donkey* are said to carry novelty presuppositions, requiring that in a context of interpretation there be no pre-existing corresponding discourse referent. Heim's context, then, is an abstract notion, a set with two kinds of information. Discourse representations in Discourse Representation Theory contain variable-like elements that behave very much like Heim's discourse referents, as well as formulae that play much the same role as Heim's propositional component of the common ground; in the end, the representations contain much the same semantic content by virtue of a model-theoretic interpretation. Differences aside, in both of these theories, as well as in other subsequent work on dynamic interpretation, apart from discourse referents most contextual information can be characterized, directly or indirectly, in propositional terms, with a proposition viewed as a set of possible worlds (or situations).

Dynamic theories offer a number of advantages over the earlier index-based theories of context. Since most contextual information is basically propositional in the dynamic theories, it is no longer necessary to attempt to characterize that information as a set of indices, with all the awkwardness of attempting to determine just how many indices, and of what character, are required. With no loss of theoretical elegance, there may be any number of different types of proposition in the context, bearing on the interpretation of an utterance in as many different ways. Moreover, the context can contain information about both prior discourse and the current discourse, and it is this information that plays a central role in constraining the interpretation of any anaphoric or deictic elements that may be used. Heim treats such elements as presuppositional, and in Heim 1983b, proposes an important extension of Context Change Semantics to include a full theory of utterance presuppositions and of presuppositional felicity in context. In this extension, an utterance presupposition is taken to be a constraint on contexts of utterance. Technically, the context change potential corresponding to the utterance's logical form is undefined for any context of utterance that does not satisfy the presupposition in question. For example, in (3) above, we saw that the adverbial *too* in conjunction with the prosody of the utterance conventionally triggers the presupposition that someone other than the speaker has ordered a ham sandwich. The utterance is felicitous in the restaurant context because this context resolves the utterance's presupposition; it entails that the fellow at table 20, who is not the speaker, ordered a ham sandwich. In dynamic terms, we say that the utterance meaning, a function over contexts, is defined in this particular context of utterance; we can update this context with (3) to yield a new context. This is what it means to be felicitous in such a theory. In another context C' that did not entail that someone else had ordered a ham sandwich, the (same) presupposition would fail, leading to infelicity. That is, context update would be undefined for utterance of (3) in C' .¹⁴ Thus, dynamic theories of interpretation avoid the arbitrariness and disconnectedness of the earlier, index-based theories; each utterance looks to the preceding context to resolve its presuppositions, and in turn updates that input context with the information contained in the utterance.

We can see that such a theory realizes at least some facets of Lewis's (1979) metaphoric discourse scoreboard. We have two elements of the score: a set of propositions and a set of familiar entities, i.e., the discourse referents, and this information is updated dynamically, as in a baseball scoreboard, with each utterance corresponding to a move in the game. But will such a simple scoreboard suffice? The propositional content of this notion of context is well-suited to help capture logical relations among utterances, including entailments associated with operators and constraints on operator scope of the sort noted in (4) and (5) above. But, among other things, an unordered set of propositions fails to yield any insight into the notion of relevance so central in interpretation (Sperber & Wilson 1986s); relevance requires us to differentiate among propositions in a discourse those that are more and less relevant to the purposes of the interlocutors at any given time. And although discourse referents are helpful in developing a theory of anaphora resolution, they fail to capture what it is to be salient, and so fall short of a full theory of anaphora. Given all the things that contexts do, some of these enumerated in the previous section, it appears that we need more types of information and/or more structure in our dynamic scoreboard. The score is rather more complicated than we can capture with only propositions and discourse referents.

4. Intentions in Interpretation

Recently, several authors have begun to explore how to extend the notion of context developed in theories of dynamic interpretation to enable the characterization of a wider range of pragmatic phenomena. What would such a theory of context have to include to permit us to address all the issues mentioned in Section 2, so that the resulting notion does all that a context should do? In keeping with the strategy of the earlier

indexical theories, we could simply start adding additional sets to the two we already have, propositions in the common ground and discourse referents. For example, we could add a distinguished subset of the propositions, the topics under discussion; a subset of the discourse referents, the set of salient entities; another set of propositions characterizing Gricean maxims, principles of conversational turn-taking, and other metapinciples guiding discourse, etc. But this seems rather arbitrary, and no more illuminating than the old set of indices. We want to know what is in these distinguished sets, how they are related to each other, and how they get updated by any given utterance. In addition, the theory we have sketched so far deals only with one type of mood, indicative, and so only with a very narrow range of types of speech act. We would like to develop a more general theory, designed to deal with interrogatives and imperatives, as well, and with the full range of speech acts. Only then can we hope to have a basic framework within which to conduct pragmatic analysis, incorporating the results of a formal semantic theory.

Many theorists believe that the place to start in developing a more adequate theory of this type is with consideration of the interlocutors' intentions, following the general view of Grice (1989, and the earlier papers revised there). Grice argued that our understanding of what it is for an agent to mean something depends on the prior recognition of certain types of intentions. Roughly, we only take a speaker to mean φ if we take her to intend that we recognize that she means to convey φ and to do so on the basis of her utterance. If this seems obvious, so much the better. Contrast this view of meaning something with the notion of spilling the beans.¹⁵ We cannot inadvertently mean φ , but we can certainly inadvertently spill the beans with the same informative outcome. This intentional theory of communication is supported by recent work in experimental psychology and psycholinguistics, which strongly suggests that recognition and tracking of interlocutors' intentions is crucial to how babies learn the meanings of their first words.¹⁶ Grice's notion of mutually recognized intention depends on the assumption that interlocutors keep track of each others' intentions and assumptions, i.e., that they maintain something like a common ground. As will be briefly illustrated here, assuming that relations over intentions are the central organizing features of discourse permits us to give a conceptually simple and cohesive notion of context, which does what it needs to do to facilitate interpretation and characterize infelicity in discourse.

The notion that goals and intentions are the central organizing factors in discourse was developed within the field of artificial intelligence as Planning Theory. Grosz & Sidner (1986) argue that what they call the *Intentional Structure of Discourse* is a central organizing feature of discourse, and Thomason (1990) argues that recognizing the role of such intentions is central in the development of a theory of pragmatics.¹⁷ Following Stalnaker (1978), I assume that the primary goal of discourse is communal inquiry—the intention to discover with our other interlocutors "the way things are", i.e., to share information about our world. Drawing on Stalnaker's notion of the COMMON GROUND and the related CONTEXT SET (the intersection of the common ground, i.e., the set of worlds in which all the propositions in the common ground are true), we can say that our goal is to reduce the context set to a singleton set, the actual world. The linguistic counterpart of an inquiry is a question. Thus, we might take questions to be the formal objects that reflect interlocutors' intentions in conducting discourse. In that vein, Ginzburg (1996b) and Roberts (1996a) propose that interlocutors' discourse goals and intentions be encoded as the set of QUESTIONS UNDER DISCUSSION in the discourse, expanding the information in the discourse context to include a partially ordered set of such questions, as well as the propositions in the interlocutors' common ground.

To understand how goals and intentions fit into the context of discourse, let us pursue Lewis's metaphor of the discourse context as a scoreboard and consider the character of the corresponding language game.¹⁸ The principal elements of a game are its goal(s), the rules that players abide by, the moves they may make towards achieving the goal(s), and the strategies they may pursue in making their moves, the last generally constrained by the first three and, above all, by rational considerations. The goal of discourse is to conduct inquiry by answering the questions under discussion. There are two types of RULES in the language game, both viewed as constraints on the interlocutors' linguistic behavior: conventional rules (syntactic, compositional semantic, etc.) and conversational rules (e.g., the maxims of Grice 1967). The latter are not properly linguistic, but are given by rational considerations in view of the goal of the game. For example, the Cooperative Principle follows from the fact that playing the language game is a coordination problem, à la Lewis (1969); the Maxim of Quality from the fact that truth is the ultimate goal; and the first part of the Maxim of Quantity from the desire to maximize the payoff of a move in view of the players' commitment to the ultimate goal and of human cognitive limitations (in this light, cf. the discussion in Sperber & Wilson 1986a of the Maxim of Relevance and the second Maxim of Quantity).¹⁹ There are two types of MOVES that players may make—linguistic behaviors that fall under the kinds of acceptable

behavior defined by the rules and that are classified on the basis of their relationship to the goals of the game: what Carlson calls SET-UP MOVES, which are questions, and what he calls PAYOFF MOVES, which are assertions, providing the answers to questions.²⁰ Note that moves, as intended here, are not speech acts, but rather the semantic objects that are expressed in speech acts: A speech act is the act of proffering a move. I will return to discuss strategies of inquiry just below.

I assume that there are two aspects to the interpretation of any given move, its PRESUPPOSED CONTENT and its PROFFERED CONTENT, which correspond to the two ways that context enters into interpretation, as discussed in Section 2. The presupposed content of an utterance constrains the types of context in which it may be felicitously uttered. The term PROFFERED is a cover term for what is asserted in an assertion and for the non-presupposed content of questions and commands; hence, this is that part of the content of an utterance that determines how the context of utterance will be updated. Lewis (1969) treats questions as a type of imperative; this seems correct in that a question, if accepted, dictates that the interlocutors choose among the alternatives that it proffers.

Most contemporary semantic analyses regard a question as denoting or determining the set of propositions that are the possible answers (or correct answers, in some theories) to that question; these are the proffered alternatives. If a question is accepted by the interlocutors, this commits them to a common goal, namely, finding the answer. Like the commitment to a goal in Planning Theory, this is a particularly strong type of commitment, one that persists until the goal is satisfied or is shown to be unsatisfiable. The accepted question becomes the immediate topic of discussion, i.e., the immediate question under discussion. When interlocutors accept a question, they form an intention to answer it, which intention is entered into the common ground.²¹ If a cooperative interlocutor knows of this intention, then she is committed to it, i.e., she herself (ostensibly) has an intention to answer the question. Then Relevance, an organizing principle of discourse that supports coherence and, hence, facilitates the processing and storage of information, will lead her to attempt to answer it as soon as possible after it is asked. Grice's first maxim of Quantity, in view of the goals of discourse, makes a complete answer preferable to a partial one, all other things being equal.

Assertions are, as for Stalnaker, choices among alternatives. If accepted, they are added to the common ground, and thereby reduce the context set. In order for discourse to be coherent (i.e., adhere to Relevance), it must be clear which alternatives (corresponding to cells in a partition on the context set) a given assertion selects among. The relevant alternatives are those proffered by the question, or topic, under discussion. That's the sense in which assertions are payoff moves: they choose among the alternatives proffered by a set-up move/question, and in so doing they further the goals of the game. Non-sequiturs are assertions that don't bear on the question under discussion; even though they may be informative in the abstract, they reflect poor strategy and a lack of commitment to the immediate goals of the discourse, i.e., a lack of cooperation. Non-sequiturs also fail to maximize payoff; good strategists make assertions with a view to optimizing the number of relevant inferences that they will trigger, and it seems reasonable to assume that such inferences are facilitated by the discourse segmentation induced by the plan structure of the discourse (see Grosz & Sidner 1986 and Sperber & Wilson 1986a for extensive discussion and exemplification, though the latter don't use the term "discourse segmentation").

STRATEGIES OF INQUIRY 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 subgoals (addressing subquestions) that are easier to achieve and that 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 & Stokhof (1984:16): 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, since otherwise the entailments can actually go the other way around.) For example, "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 that it entails a SUBQUESTION. On the other hand, if we can answer enough subquestions, we have the answer to the super-question. 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.

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 that 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 subquestions, 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.

Thus, 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 & Lascarides (1998a):

- (9)
- 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, (10) gives the update dynamics of the discourse context in (9). 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 abstract informational entities.

- (10) Dynamics of the Context for Discourse (9):

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, that tickets require payment, etc.

C+(9a):

Discourse Referents:	{ <i>x</i> =1:20 train to Philadelphia}
Domain Goals:	{A catches <i>x</i> }
QUD:	< <i>how does one catch x?</i> >
CG:	general world knowledge among strangers + { <i>A needs to catch x</i> }

(*C*+(9a))+ (9b):

Discourse Referents:	{ <i>x</i> =1:20 train to Philadelphia}
Domain Goals:	{A catches <i>x</i> }
QUD:	< <i>how does one catch x?, where is x leaving from?</i> >
CG:	general world knowledge among strangers + { <i>A needs to catch x, A inquired about where x is leaving from</i> }

((*C*+(9a))+ (9b))+ (9c):

Discourse Referents:	{ <i>x</i> =1:20 train to Philadelphia. <i>y</i> =platform 7}
Domain Goals:	{A catches <i>x</i> }

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+(9a))+(9b))+(9c))+(9d):	
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+(9a))+(9b))+(9c))+(9d))+(9e):	
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 (9a) is an assertion, and unless B objects, it is added to the common ground; the train itself simultaneously becomes a familiar and salient discourse referent. It is also clear from the content of (9a) (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 of the question of how to catch the train. (9b) poses a question that is Relevant in that it seeks information required to catch the train and hence 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 subquestion 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 (9c) 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 (9c) has resolved the question of where the train leaves from, A initiates the next phase of his overall strategy to achieve the domain goal, introducing the discourse goal corresponding to the question in (9d). The treatment of this question/answer pair is parallel in treatment to that in (9b,c). At the end, the information in CG entails knowing how to catch the train, so the first question is also removed from the QUD stack, 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 (11)-(14) from Mann & Thompson (1986), illustrating various types of rhetorical relations in their Rhetorical Structure Theory (Mann & Thompson 1986, 1988):

- (11) a. I'm hungry.
b. Let's go to the Fuji Gardens.
- (12) a. We don't want orange juice.
b. We want apple juice.
- (13) a. I love to collect classic automobiles.
b. My favorite car is my 1899 Duryea.

- (14) a. Go jogging with me this afternoon.
b. You'll be full of energy.

The assertion in (11a) 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. (11b) 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.

(12) is an example of the rhetorical relation Mann & Thompson call CONTRAST. Note that this contrast would be reflected in the 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.²² Here, the narrow focus on each utterance would presuppose that they both address the question of what the speaker and other individual(s) referred to by *we* want, contrasting two possible answers. If that (probably implicit) question weren't Relevant in the preceding discourse, then utterance of (12) 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. By looking at the discourse fragment with a view to the presupposed question under discussion, however, we capture both the contrast and felicity.

(13) 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 implicitly or explicitly under discussion, (13a) would be a (possibly only partial) answer. The elaboration in (13b) 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 (13b) would be more helpful than the direct answer in (13a) alone, and in keeping with Planning Theory generally, a cooperative interlocutor attempts to address what the query is really after, rather than offering only the information literally requested.

(14) 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 (14a) 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 response "Why should I?". (14b) is relevant to (14a) by virtue of addressing this question of why the addressee should adopt the goal suggested by (14a). This understanding is triggered by the need both to determine the Relevance of (14b) 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. It illustrates a prevalent feature of the language gameplan, which is modelled more abstractly in Planning Theory via Plan Inferencing Rules that permit one to infer interlocutors' plans from other information in the common ground plus what is actually said. Similarly, sometimes answers that 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 that 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.

Let us summarize the picture of context and its role in the dynamic interpretation of a language game that we have developed to this point. I assume that a LINGUISTIC STRUCTURE is an ordered pair of a syntactic structure (with associated lexical items) and a prosodic structure. The interpretation of such a structure is its context change potential, a function from contexts (the potential contexts of utterance) to contexts (the updated contexts resulting from their utterance). An UTTERANCE is then an ordered pair of a linguistic structure and a context of utterance. A context is a scoreboard, a way of keeping track of the various types of information being shared in discourse. Like a scoreboard, it is ideally public, though of course, in language as well as in stadiums, it isn't always the case that everyone actually has a clear view of the scoreboard. The types of information and the way in which they get updated by the proffering of various types of linguistic structure are constrained by the rules of the language game. Here are the facets of the score we have alluded to so far:²³

(15) **Context in Dynamic Interpretation**

At a given point in a discourse, the discourse context is an ordered tuple, with at least the following elements:

- a set of Discourse Referents, intuitively the set of entities under discussion;
- a set of sets of Domain Goals, to wit:
 - a set of Domain Goals for each interlocutor, what that person is taken to be resolved to achieve, including goals suggested by imperative moves addressed to that person and subsequently accepted, and
 - a set of common Domain Goals, those which the interlocutors are (at least ostensibly) committed to achieving together;
- the set of Moves made up to that point in the discourse, with a total order on them corresponding to the order in which they were proffered;
- the set of Questions under discussion in the discourse, the QUD: those interrogative moves that have been accepted by the interlocutors and have not yet been satisfactorily answered;²⁴
- the set of propositions reflecting the interlocutors' Common Ground.²⁵

The rules of the language game constrain how different types of linguistic structures update the discourse context, with the following principal effects:²⁶

(16) **Pragmatics of Questions:**

- (a) If a question is accepted by the interlocutors in a discourse, then it is added to the set of questions under discussion.
- (b) A member of the set of questions under discussion in a discourse is removed from that set iff its answer is entailed by the common ground or it is determined to be unanswerable.

(17) **Pragmatics of Requests:**

If a request is accepted by an addressee *i* in a discourse, the set of *i*'s goals is updated with the information expressed by the corresponding indicative, with *i* taken as the denotation of the subject.

(18) **Pragmatics of Assertion:** (following Stalnaker 1978)

If an assertion is accepted by the interlocutors in a discourse, it is added to the common ground.

The acceptance of a move of any type in the language game depends on its felicity in the context of utterance. If all of the move's presuppositions (in the extended sense suggested in Section 2) are satisfactorily resolved and the move is accepted by the interlocutors, this leads to an update of the context in the way specific to that type of move. We can then capture Gricean maxims, rules of turn-taking, and other global constraints on well-formed discourse as metapresuppositions, required to be satisfied for every move. For example,, consider the following characterization of Relevance:²⁷

- (19) A move *m* in a discourse game is **RELEVANT** to the question under discussion *q* iff *m* either introduces a partial answer to *q* (*m* is an assertion) or is part of a strategy to answer *q* (*m* is a question subordinate to *q* or an imperative whose realization would plausibly help to answer *q*).

In keeping with the claim that discourse intentions and the questions that express them structure discourse, we also want to guarantee that all of the assertions in a discourse are at least partial answers to accepted questions, and that in fact each is a (partial) answer to the question under discussion at the time of utterance. This follows from the way that Relevance is defined in (19); cf. the relativization of Grice's Maxim of Relevance to "the purposes of the discussion". Without something along the lines of Relevance, it is hard to see how to predict that a given structure would be infelicitous in a given context. And without intentions and goals, it is hard to see how to define Relevance in a way that makes sense for dynamic interpretation. Adding a set of questions under discussion to the characterization of context gives us a way of capturing Relevance in a linguistically relevant way.

The above suggests that some notion of the intentions of interlocutors in discourse is crucial to capturing Relevance, and hence adequately addressing a number of features of discourse context, felicity, and context update. There are various ways we might imagine extending this approach to handle other types of pragmatic phenomena. For example, one can use the intentional structure represented by the questions under discussion to characterize the set of salient entities at that point in the discourse, as suggested in Grosz & Sidner 1986.²⁸ This would involve adding an ordered subset of the set of discourse referents, the SALIENT ENTITIES, to the types of information in (16), and modifying the context update rules to manage what was in the set of salient entities at a given time in discourse. And one would certainly want to implement some tactics for plan inferencing, in order to infer speech acts (see the earlier work of Perrault 1990), and ultimately to draw conversational implicatures as well.

In addition to exploring such extensions, we might want to explore other ways of characterizing the intentions of interlocutors in discourse and the relationship of these intentions to questions and other sorts of speech act. In a series of recent papers, Asher & Lascarides (1994, 1998a,b) have discussed various facets of an ambitious project to model discourse processes within a version of Discourse Representation Theory. While their theory makes prominent use of information about interlocutors' intentions, it also makes crucial and extensive use of rhetorical relations, taken to be primitives of the theory. And their theory does not make the types of connections between intentions and questions, and between rhetorical relations and strategies of inquiry, which were discussed above. Asher & Lascarides also go well beyond the discussion here to propose certain principles for plan inferencing and to explore their interaction with the process of interpretation. A careful comparison of the two types of theory is beyond the scope of this handbook entry. However, such a comparison should ultimately prove useful in determining the extent to which the various structures and principles in discourse are independent of each other.

5. Conclusions

Developing an adequate characterization of the notion of discourse context is arguably at the heart of a fully adequate, integrated theory of pragmatics. Other notions, including presuppositional relations, rhetorical relations, and other facets of what makes a discourse coherent (Halliday & Hasan (1976), Kehler (this volume)) and felicitous, can arguably best be captured in terms of an appropriately modelled relation between a linguistic expression and its context of utterance. In order to do so, however, it is crucial that we include among the types of information tracked in context information about the intentions of the interlocutors and general constraints on how these intentions are related to each other in felicitous discourse. Under these assumptions, the resulting model of context, appropriate rules for the semantic interpretation of particular structures and lexical items (which draw on contextually available information), and a suitable inference engine to generate contextual entailments will together yield a satisfactory theoretical account of how context comes to influence interpretation.

Of course, in actual discourse interlocutors have to do a lot of guesswork to maintain control of a speaker's assumptions about context and, hence, about how particular utterances will be interpreted. In the theory of Hobbs et al. (1993) (see also Hobbs, this volume), the fact that we must guess at the assumed context is captured by characterizing actual on-line interpretation in terms of abduction, a process whereby one figures out what the speaker must have assumed the context to be in order for her utterance to denote a true proposition.²⁹ Hobbs's theory is perfectly compatible with the claim made here that in the ideal discourse pragmatic enrichments of the timeless meaning of an utterance are, like presuppositions,

contextual entailments. The basic theoretical task is to predict the particular interpretations that would be given to particular utterances by ideal hearers who had a **complete and mutually consistent understanding** of the context. The often incomplete and inconsistent character of actual interlocutors' information about contexts of utterance and the strategies they adopt to compensate for lack of omniscience in this respect—including redundancy³⁰ and abductive inference—are of considerable theoretical interest, but this should not obscure the basic, abstract character of discourse context.

One interesting facet of contemporary work on dynamic interpretation and context-dependence is its inter-disciplinary character. Some of the best work in this area is being carried out within computational linguistics and artificial intelligence.³¹ Although one reason for this is undoubtedly the heightened commercial interest in creating natural language systems that are more pragmatically sophisticated, another stems from the nature of pragmatics itself. The domain of pragmatics includes phenomena at the edge of linguistics proper, the outcome of the interaction between purely linguistic structures (syntactic, phonological, etc.) and more general cognitive capacities and attitudes (inference, perception, belief, intentions, and the like). We cannot adequately characterize such interaction without taking into account this interaction and all the factors that play into it. And hence, purely linguistic study of pragmatics will never yield as much insight as study that takes into account nonlinguistic factors as well.

Notes:

¹These are methodological assumptions, and not the sort of thing one could prove. While there are fascinating difficulties in maintaining these assumptions, they have proven an excellent point of departure in theory building and make it possible to understand the productive character of our semantic competence. See Dowty 1979 and Partee 1984a for relevant discussion about these foundational issues.

²Lewis (1972:173) advises semanticists: "In order to say what a meaning *is*, we may first ask what a meaning *does*, and then find something that does that."

³The exact character of the presupposition association with definite descriptions is disputed. See Russell 1905, Heim 1982, Kadmon 1990, Neale 1990, and Roberts to appear for a range of suggestions, and Abbott this volume for general discussion.

⁴See Karttunen 1973, Stalnaker 1974, and Beaver 1997 for extensive discussion of presupposition satisfaction.

⁵See Kasper et al. 1999 for extended discussion of this idea, as well as a sketch of its computational implementation, within the framework for pragmatic analysis proposed in Roberts 1996a.

⁶Kripke is said to have made this observation about *too* at a workshop on anaphora at Princeton University in 1990.

⁷See McCafferty 1987, Thomason 1990, Welker 1994, and Roberts 1996b for discussion and illustration.

⁸See the work on conversational analysis for discussion of these principles, e.g., Sacks et al. 1974, and the papers in Atkinson & Heritage 1984.

⁹This approach goes back at least to Jackendoff 1972 in the generative literature, and is explored (under a variety of different theoretical assumptions) in more recent literature, for example in Vallduví 1992, Roberts 1996a, and Schwarzschild 1999. See also Gundel & Fretheim this volume.

¹⁰See Ward 1988.

¹¹See the introduction and papers in Walker et al. 1998.

¹²There is a lot of variation even within one general approach. For a very good, accessible introduction to File Change Semantics (Heim 1982) and Discourse Representation Theory (Kamp 1981, Kamp & Reyle 1993) and a comparison of the two theories, see Kadmon 2000. For a fairly accessible introduction to a theory close to the Dynamic Montague Grammar of Groenendijk & Stokhof (1990), see Chierchia 1995.

¹³Again, see Chierchia 1995 for extended discussion and Roberts (to appear) for an alternative approach and references to the extensive literature.

¹⁴Of course, interlocutors might accommodate the failed presupposition, adding it to *C'*, but then the accommodated context wouldn't be *C'*, but its update as accommodated.

¹⁵For non-native speakers of English: *spill the beans* is an English idiom meaning something like "inadvertently reveal information".

¹⁶See Bloom 2000, especially Chapter 3, for extensive discussion of this idea, with review of the relevant experimental literature. Note that this notion is not incompatible with the view that there is something like an innate Language Acquisition Device, e.g., for phonology and syntax. Even with such an innate ability to acquire linguistic structures when exposed to particular languages, there remains the problem of grasping

intended reference and comprehending the conventional extensions of kind-denoting expressions, etc. This is where pragmatics comes in.

¹⁷ See also Pollack 1986, Litman & Allen 1990, and much other work in this vein.

¹⁸ The development of these ideas here is a modification of that in Roberts 1996a, which was, in turn, inspired by Carlson 1983, where they are developed quite differently. Of course, ultimately the comparison of discourse to a game goes back to Wittgenstein (1953), and has been picked up by others, including Lewis (1969) and, of course, Carlson's mentor Hintikka (e.g., Hintikka 1973, 1981; Hintikka & Saarinen 1979).

¹⁹ Here and below, I capitalize the Gricean notion of Relevance and the related formal notion that I will define in what follows, to distinguish them from the ordinary English term.

²⁰ As we will see below, there is a third sort of semantic object expressible by imperatives, which also establish goals, although of a different type than those established by accepted questions.

²¹ This is in distinction to Carlson's epistemic desideratum of a question, which has to do with increasing the knowledge of the questioner, and with the related views of Ginzburg (1996a). On the present view, it is the common ground, not the speaker, that is "informed", and it is mutual-belief-behavior, and not knowledge, that is sought. This permits a generalization over rhetorical questions, quiz questions, etc., which are problems for more solipsistic views of information in discourse.

²² See Roberts 1998b for application of the theory to the comparative analysis of Hungarian and English, and Kadmon 2000 for comparison of this general approach to Focus with others in the contemporary literature.

²³ See Roberts 1996a for a detailed formal proposal.

²⁴ Questions ideally remain in the QUD until either answered or abandoned as practically unanswerable, at which time they are removed. So the QUD is non-monotonic, in the sense that information added to it at one point may be removed later.

²⁵ Unlike the QUD, the Common Ground is ideally monotonic, so that once added, information does not get removed. Of course, sometimes interlocutors discover that they were wrong, and then the Common Ground must be corrected accordingly. However, this involves an often very difficult repair strategy, and is not the normal way of updating the Common Ground.

²⁶ There will typically be other effects, as well. For example, if a question is asked, the fact that it is asked is entered into the common ground, whether or not it is accepted, by virtue of the fact that the asking is a speech act performed in full knowledge of all the interlocutors and that such (non-linguistic) shared information is also represented in the common ground. If the question is accepted, then the interpretation of the question and the fact that it was added to the set of questions under discussion at that point also becomes part of the common ground, by virtue of the way that the character of the changing context is continuously reflected in the common ground.

²⁷ This calls out for comparison with Sperber & Wilson's (1986a) notion of Relevance. A detailed comparison is not possible here, but I will note two significant differences between their notion and that given in (19): First, Sperber & Wilson's Relevance reflects their reductionist program, since it is intended (so far as I can understand) to play the role of all of the original Gricean conversational maxims. (19) is not reductionist; e.g., it is not intended to account for Quantity implicatures. Second, Sperber & Wilson do not relativize their notion to the interlocutors' immediate intentions or goals (and in fact, they deny the very possibility of a common ground), so that the maximization of informativeness while minimizing processing cost is calculated absolutely. But the Relevance defined in (19) is, crucially, relativized by the interlocutors to the question under discussion, and hence, given the pragmatic function of questions in information structure, to the interlocutors' goals.

²⁸ Roberts (1998a) sketches how this might work in a version of Discourse Representation Theory.

²⁹ I would add that the proposition must not only be **true**, but also **Relevant**.

³⁰ See Walker 1993 for extended discussion of the frequency and function of redundancy in discourse.

³¹ In addition to work already cited, see the work by Johanna Moore, Richmond Thomason, Karen Lockhaum, and their associates, including Lochbaum 1993, Moore 1995, Thomason & Moore 1995, Moser & Moore 1996, and Thomason et al. 1996. Grosz (1997) presents a useful overview of the field, with extensive references. And Thomason has an excellent bibliography on context available on his website: <http://www.eecs.umich.edu/~rthomaso/bibs/context.bib.txt>.

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