An Update Semantics for Dialogue

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Abstract

In this paper I provide a situation theoretic update semantics for dialogue motivated, in part, by concerns of ellipsis resolution in phrasal utterances, and based on the notion of a dialogue game (Hamblin 1970, Carlson 1983, Houghton and Isard 1986). I offer arguments that the rules for dialogue updating need to make reference to the existence of distinct versions of the conversational scoreboard (Stalnaker 1978, Lewis 1979), relativised to each dialogue participant. The leading idea is that taking a sufficiently structured view of the common ground enables us to characterize the potential for discussion at any given point in the conversation. In particular, I show how the potential for grounding moves (Clark and Schaefer 1989) and side sequences (Sacks and Schegloff 1973) can be explained from principles characterising assertion and querying.

1 Introduction

What one might call the “classical” dynamic picture of contextual change is a view one can trace most directly to Stalnaker’s 1978 paper on assertion. On such a view context at time \( t \) is identified with the set of assumptions the conversational participants hold \emph{commonly at \( t \)}. How does context change? The most prominent way Stalnaker discusses is for a participant to make an assertion. The descriptive content of that assertion is then added to the \emph{context assuming none of the other participants object}. On this view, conversational context is analysed as a construct created \emph{jointly} by the various participants. While Stalnaker does acknowledge the possibility of an \emph{individualist} perspective, he claims that each participant has his own context set (the set of possible worlds that are live options relevant to the conversation-J.G.), but it is part of the concept of presupposition that a speaker assumes that the members of his audience presuppose everything that he presupposes. We may define a \emph{non-defective context} as one in which the presuppositions of the various participants in the conversation are all the same... in the normal case, contexts are non-defective, or at least close enough to being non-defective. (Stalnaker 1978 p. 322)

In this paper, I will consider a number of dialogue phenomena that suggest the need for both a more \emph{individualistic} and more \emph{structured} view of context: that is, at a given point, \emph{distinct} individuals can have \emph{distinct} semantic options; context has \emph{components} only some of which a given conversational contribution need interact with.

After considering some data in section 2, in section 3 I lay out some strategic assumptions on the basis of which the model will be constructed. I then explain how assertion and querying are to be analysed. In section 5, I provide an overview of the situation theoretic framework underlying the model. With this in hand, I move to analyze the initial data: in particular, I show how the potential for grounding moves
(Clark and Schaefer 1989) and side sequences (Sacks and Schegloff 1973) can be explained from principles characterising assertion and querying motivated in section 4.

2 Three Puzzles

2.1 Puzzle #1

(1a) A: Who left the institute before 5? Why?

(1b) A: Did Bill buy that book for Mary? At what time?

(2a) A: Who left the institute before 5?
   B: Why?

(2b) A: Did Bill buy that book for Mary?
   B: At what time?

In (1a) and (1b) respectively, where ‘why’ and ‘at what time’ are uttered by a single speaker, they get resolved to mean approximately:

(3a) Why did they, those people that left the institute before 5, leave?

(3b) At what time did Bill buy that book for Mary?

In (2a,b), however, ‘why’ and ‘at what time’ cannot mean (3a,b), rather, the only available resolutions are paraphrasable as:

(4a) Why is A asking B who left the institute before 5?

(4b) What time is A asking whether Bill bought that book for Mary at t?

There are two facets to the puzzle: first, in what way is the context in (1a,b) different from the context in (2a,b) to effect such radically distinct context change? Second, how can such readings be derived?

2.2 Puzzle #2

The dialogue in (5a-f) occurs in the London–Lund corpus (Svartvik and Quirk 1980):

(5a) A:... I've been at university.
(5b) B: Which university?
(5c) A: Cambridge.
(5d1) B: Cambridge, um. (5d2) what did you read?
(5e) A: History and English.
(5f1) B: History and English. (5f2) did you see the last issue of TLS?
    (London Lund, S.2.2, p. 419)

Neither (5d1) nor (5f1) are redundant conversational moves. The puzzle here is: in what way does the context change so that A's utterances in (5c) and (5e) are distinguished in their import from B's utterances in (5d1) and (5f1)? Why could (5c) and (5e) instead equally felicitously be followed up with the following queries:

(6d1) B: Cambridge?
(6f1) B: History and English?

What would these latter utterances mean?

2.3 Puzzle #3

Alice and Benito are standing inside an elevator. Benito is standing next to the control panel, while Alice stands well inside the elevator. Benito asks

(7) Benito: Which button?

The question is: what is the content of Benito's utterance? Is it (10a) or (10b) or (10c) or (10d)?

(8a) which button should B press?
(8b) which button should B select?
(8c) which button does A desire that B select?
(8d) which button would A most desire that B press?

On the one hand none of the putative contents or their obvious alternatives have any clear priority over
any of the others. Hence, it is unlikely to expect Alice resolving the ellipsis identically to Benito. Nonetheless, assuming Alice is in reasonable command of her senses, she will not respond ‘which button what?’, as she should if she could not ‘resolve the ellipsis’, rather Alice will say ‘6’ (or whichever floor she actually desires to get to.) In short: successful communication has ensued. The puzzle is this: How can successful communication have ensued when there is no univocal content to assign to the utterance?

3 The Framework: strategic assumptions

My claim will be that at the heart of the solution to these puzzles lies the recognition that conversation involves individual actions by distinct individuals which are, albeit, coordinated. The fact that one dialogue participant (DP) has made a particular move which she classifies as being of some type μ₀ does not in and of itself cause any other participant, call him DP2, to reach an identical new contextual state. Crucially, DP2 is required to perform action on her part as a precondition for DP1’s move being registered (cf. (5d1), (5f1) above). What I will argue is that even if DP2 registers DP1’s move that will not, in many cases, situate him in the same contextual state as DP1. This conclusion, one that will figure in the solution of all three puzzles, is perhaps not particularly surprising if one takes an action oriented view of dialogue, but it moves some way apart from a view of conversation as a sequence of updated common grounds. Nonetheless, capturing with some increased precision the Sthanhakarian view of assertion will serve as an important guiding light.

The whole sequence, DP1 making a move and DP2 indicating that he has registered that move is what Clark and Schaefer 1989 dub the grounding of an utterance:

[After each contribution in dialogue] The contributor and his partners attempt to satisfy the grounding criterion: the contributor and his partners mutually believe that the partners understood what the contributor meant relative to their own purposes. (Clark and Schaefer 1989, In: Clark 1993, p. 148.)

On Clark and Schaefer’s view, that builds on work in conversational analysis and is motivated through analysis of conversations in the London Lund corpus, a grounded contribution is one that consists of a presentation move m₁ (assertion, query etc ) and an acceptance move, m₂(m₁), in which the addressee of m₁ indicates that the grounding criterion is fulfilled. If the latter does not hold, then a side sequence starting with the addressee posing a clarification query ensues.

Clark and Schaefer’s view raises a number of important issues. First, the grounding criterion presupposes a notion of understanding what a contributor meant relative to a purpose. What does this amount to in formal terms? Second, since an acceptance move also communicates a content, it should itself trigger an acceptance move and so forth; regress sets in immediately. Clark and Schaefer suggest that this process is subject to decay in a hierarchy of ‘strength’ of acceptance phrases: initial acceptances will tend to be overt phrases, whereas further down the line nodding or mere eye contact serve. This still leaves open the nature of the semantic mechanism for avoiding regress. Third, Clark and Schaefer claim that dialogue can only be explained by posulating a series of collective rather than individual actions. To what extent is this assumption necessary?

In what follows I will sketch a framework which tries to address each of these issues; in particular, I will attempt to show that one can account for the phenomena at issue without the assumption of collective action.

How to talk about an individual in dialogue? I propose the following schematic partition. On the one hand, we need a way of talking about some quasi-shared object, each DP’s version of the common ground, relative to which conventionalized interaction will be assumed to take place. This is because I adopt the assumption built into the notion of a dialogue game, (e.g. Hamblin 1970, Carlson 1983, Houghton and Isard 1986), that interaction in conversation can be characterised in terms of a small
number of primitive move types which set up a restricted set of options or, perhaps obligations (Traum and Allen 1994). This component I will call the DP’s gameboard (cp. Hamblin’s 1970 notion of ‘individual commitment state’).

Separate from this will be the non-publicized aspects of each participant’s mental state; I will call this DP’s unpublished mental situation (UNPUB-MS(DP)). Typically, such things as goals and inferential capabilities will be represented here. As we shall see below, various aspects of the conventionalised interaction will be parametrized by the UNPUB-MS(DP).

Thus, a participant in a dialogue is modelled as a set of triples, each triple of the form \(<GB,ms,t>\) (‘a gameboard configuration GB, coupled with a mental situation ms at time t’). A mental situation, a term I use following Cooper and Ginzburg 1994, is a situation that supports inter alia inferences of the form \(\langle BELIEVE, a, T, f, \rangle\), T a situation theoretic type, \(f\) an assignment. Using such situations, inspired by e.g. Barwise and Perry 1983 and Kamp 1990, it is shown in that paper how to provide a rudimentary theory of mental states with which various puzzles about attitude reports can be solved. A gameboard is a situation which represents a DP’s view of certain attributes of the dialogue situation. Which attributes?

In Ginzburg 1994b I argue in detail for the need to structure a Stalnakerian context. I assume and provide here further motivation for that analysis that uses three attributes whose (range of) values are informally described as follows:

- FACTS: set of commonly agreed upon facts;
- QUD (‘questions under discussion’): partially ordered set that specifies the currently discussable questions. If \(q\) is topmost in QUD, it is permissible to provide any information specific to \(q\).
- LATEST-MOVE: content of latest move made: it is permissible to make whatever moves are available as reactions to the latest move.

4 Assertion and Querying

For the moment, I ignore issues pertaining to communication and assume a perfect flow of information between the two DP’s. The semantic discussion will likewise be informal with details arriving in the following section.

The first issue I consider is how, within such a structure, to provide an account of an assertion sequence that allows in addition to acceptance and rejection also the option of discussion, as exemplified in the dialogue in (7) where B’s assertion in (7a) is challenged by A in (7c), taken up by C in (7e), and leads to a corrected assertion by B in (7f, h, j):

(9a) B: Yes. Well, father would have been seventy eight
I suppose, if he had been alive still
(9b) C: Good Lord
(9c) A: That all?
(9d) C: Goodness
(9e) C: My father would have been a hundred and twenty seven

(9f) B: No, not seventy eight, eighty eight
(9g) A: (coughs)
(9h) B: Yes. (simultaneous with next turn) no, yes
(9i) A: As bad as Charlotte’s
(9j) B: No, not seventy eight. yes, eighty eight.

(London Lund, S.1.13, p. 333)

Consider a sequence in which DP1 makes an assertion that \(p\). If FACTS is to serve as some sort of common ground repository, DP1 cannot, with an important caveat which shall come to later, update FACTS before receiving acceptance from DP2. What does he do in the meantime? I suggest that what he does is update his QUD with the question whether \(p\) as its topmost element.

What options does DP2 have now? Her LATEST-MOVE now contains the information:

(10) LATEST-MOVE: DP1 asserts that \(p\).

DP2 now has two possible classes of reactions:

- Accept \(p\): in this case, DP2 adds to her FACTS attribute the fact that \(p\); at this point, she can either explicitly utter an acceptance phrase (‘I
see ’, ‘uh huh’, nod head); Or move on: DP2’s QUD at this point is a (not necessarily proper) subset of what it was before DP1’s assertion. So DP2 can introduce a new question for discussion, either by assertion or by querying.

• **Discuss whether p:** in this case DP2 adds as the topmost element in her QUD the question *whether p* and produces an utterance specific to the question.

How does DP1 react now? Assume DP2 explicitly accepted DP1’s assertion. Then, DP1 registers:

(11) **LATEST-MOVE:** DP2 accepts that p.

Since this information constitutes information that resolves the question *whether p*, currently topmost in his QUD, DP2 can utilise the following general principle of downgrading QUD.1

(12) **QUD DOWNDATING:**
If q is currently topmost in QUD, accepting information ψ that either (a) resolves q relative to UNPUB-MS(DP) or (b) indicates that no information about q can be provided removes q from QUD and licenses adding to FACTS  
(1) ψ AND, if (a) applies, (2) that ψ RESOLVES q relative to UNPUB-MS(DP)

whether p gets removed from QUD and the resolving information, in this case the fact that p gets added to FACTS. So, at this point the fact that p is in FACTS on both gameboards. If, on the other hand, DP2 did not accept that p, this means that the question *whether p*, will at this point be the topmost element of QUD for both DP’s. The principles we formulate will ensure that discussion on this topic will continue until either the question is resolved or one DP indicates she cannot provide more information concerning that question.

Now consider the third and last possible action that DP2 might (be assumed to) have performed, implicitly acceptance. This case is particularly important for assertive moves unlikely to provoke controversy, whether when someone is giving a lecture or engaged in instruction, or, with respect to “metalinguistic” interaction such as acceptance of acceptances. This third option is one which introduces a certain degree of indeterminacy, but will be a vital tool in supressing regress. This option is an inference move which allows a DP to accomodate into FACTS the fact that the topmost question in QUD is positively resolved.

(13) **ASSUME:**
if q is topmost in QUD, it is permissible to add the fact *that there exists a fact positively resolving q* to FACTS. Optionally, remove q from QUD.

The relation POSITIVELY-RESOLVES is defined in section 5: it will turn out that for a question of the form *whether p*, all and only facts proving *that p* stand in this relation to the question. In particular, then, returning to our assertion case, if DP1 receives neither explicit acceptance nor discussion, he is entitled to update FACTS with the fact that p, the point of his original assertion.

How do queries work within this system? Here the main issue concerns the establishment of a particular question as *the question to be discussed*. One needs to make allowances for the fact that the person who responds to the query might not wish to adopt the question posed by the querier, although an initial rejection of discussion does not mean the original question gets erased from the context. This is illustrated in the (constructed) dialogue in (14), where on her final turn the responder exploits the presence of the original question in her context in providing an elliptical answer specific to that question:

(14a) A: Hey, guess who showed up to lunch.
(14b) B: I don’t want to.
(14c) A: Why not?
(14d) B: Don’t want to.
(14e) A: Please.
(14f) B: Oh ok. Millie.

1The basic notions characterising questions, aboutness and resolvedness, are defined in section 5.
The basic protocol is this: if DP1 poses the question q he adds q as topmost element in (his own) QUD. If DP2 registers his LATEST-MOVE that:

(15) LATEST-MOVE: DP1 QUERY q, then DP2 has two options:

- **Accept q for discussion**: update QUD so that q becomes topmost, provide q-specific utterance.
- **Reject q for discussion**: in this case DP2 adds q to QUD, but since she is going to assert her unwillingness to discuss q, she adds the question pertaining to this, viz. ‘whether DP2 will discuss q’ as topmost in her QUD; DP2 can now utter a rejection phrase (‘I don’t want to talk about that’, ‘Never mind q’ etc.)

DP1’s reaction to DP2’s LATEST-MOVE: if DP1 accepted q for discussion, then q is topmost in both QUD’s now, so discussion of q will proceed in accordance with QUD downdate principle above; otherwise, DP1 has the option of accepting DP2’s rejection, in which case q will be removed from QUD in accordance with the downdate principle, or DP1 can discuss DP2’s rejection and try to convince her q should be discussed and so on. If he succeeds, then ‘whether DP2 will discuss q’ gets eliminated from both DP’s QUD and q is now topmost and will after all be discussed.

With this discussion of how assertion gets accepted or discussed and how questions get introduced and eliminated, we can move to discuss more question specific issues pertaining to the above rules and which will also be necessary in what follows.

5 Questions, Propositions, and Facts in Situation Theory

5.1 Ontology

The semantic framework utilized here is situation theory (e.g., Barwise and Perry 1983, Barwise and Etchemendy 1990, Barwise and Cooper 1991). The view of questions utilized here is the framework described in Ginzburg 1994a. I survey the notions from that paper needed here in extremely terse fashion.

Within the latter framework, the ‘basic’ ontology consists of a set of situations, infons and n-ary abstracts, with some algebraic structure (e.g. Barwise and Etchemendy 1990 propose that the requisite structure for infons is a Heyting algebra); a proposition is individuated as a pair (s|σ), s a situation, σ an infon, whereas a question is individuated as (s?μ), s a situation, μ an n-ary infon abstract. For instance, a use of ‘Bill left’ will involve the proposition (s|⟨LEFT, b⟩), a use of ‘Did Bill leave’ will involve the question (s?⟨LEFT, b⟩), whereas a use of ‘who left’ will involve the question (s?λx⟨LEFT, x⟩)

(16) (s|σ) is TRUE iff s ⊨ σ. In such a case σ is a fact.

Questions are related to infons via two principal relations: ‘ABOUT’ and ‘RESolves’. Both these relations are formally characterised using the notion of informational subsumption, →, within an infon algebra (Barwise and Etchemendy 1990).

5.2 Aboutness

‘ABOUT’ is a relation that, intuitively, captures the range of information associated with a question independently of factuality or level of detail:

(17a) Jill: Is Millie leaving tomorrow? Bill: Possibly/It’s unlikely/Yes/No.

Bill provided information about whether Millie is leaving tomorrow. (We have no indication whether this information is reliable.)

(17b) Jill: Who is coming tonight? Bill: Millie and Chuck/Several friends of mine/Few people I know.

Bill provided information about who was coming that night. (We have no indication whether this information is reliable.)

The relation, whose formal characterisation makes crucial use of the non-classicality of the infon domain (i.e. σ ∨ ¬σ is not trivial information.) is defined as follows:

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(18a) An infor $\tau$ is ABOUT an abstract $\mu$ iff
$\tau \rightarrow [\text{APPL-INST}(\mu)] \cup [\text{APPL-INST}(\mu)]$
where APPL-INST is the set of application instances of $\mu$:

(18b) $\text{APPL-INST}(\mu) =_{def} \{ \exists f[\sigma[f = \mu]] \}$

5.3 Resolvedness
Ginzburg 1994a develops the notion of resolvedness, a contextually relativised version of exhaustiveness, in order to provide a semantics for the interrogative complements of predicates such as ‘know’ or ‘discover’ which can capture inference patterns such as the following:

(19) A certain fact is/has been V’ed
(known/discovered/told me).
Which fact? A fact that resolves the question of who left.
So, it is/has been V’ed (known/discovered/told me) who left.

Such inference patterns are highly context dependent: for instance, whether information resolves the question ‘where am I’, for a given agent, will vary depending on whether the agent is getting off an airplane (‘I am in Helsinki’ will do fine) or getting out of a taxi (‘I am in Helsinki’ will definitely not do).

This inference pattern is also what motivates the QUD downrate principle.

(20) A fact $\tau$ resolves $(s?\mu)$ relative to a mental situation $m$ ifff

1. Semantic condition: $\tau$ POSITIVELY-RESOLVES $\mu$ or $\tau$ NEGATIVELY-RESOLVES $\mu$

- $\tau$ POSITIVELY-RESOLVES $\mu$ ifff $\tau \rightarrow [\text{APPL-INST}(\mu)]$
  (for ‘whether p’: any information that entails $p$; for a wh-question: any information that entails that the extension of the queried predicate is non-empty.)

- $\tau$ NEGATIVELY-RESOLVES $\mu$ ifff $\tau \rightarrow [\text{APPL-INST}(\mu)]$
  (for ‘whether p’: any information that entails $\neg p$; for a wh-question: any information that entails that the extension of the queried predicate is empty (‘who came? No one came’).)

2. “Pragmatic” relativisation:
$\tau \Rightarrow_{UNPUB-MS} \text{Goal-content(UNPUB-MS)}$ (Intuitively: $\tau$ entails the goal represented in (UNPUB-MS) relative to the inferential capabilities encoded in UNPUB-MS.)

5.4 Question-specific utterances

(21) Given a question $q = (s?\mu)$, a $q$-specific utterance is one that either:

1. Conveys information ABOUT $q$.
2. Conveys a question on which $q$ depends.

(Here, inspired by Karttunen 1977, we define the relation of dependence between two questions as follows: $q_1$ DEPENDS-ON $q_2$ iff $q_1$ is resolved by a fact $\tau$ only if $q_2$ is also resolved by $\tau$.)

Here, then, the notion of $q$-specific utterance allows in either (potential) partial answers or questions the resolution of which is a necessary condition for the resolution of $q$ (e.g. ‘A: who committed the murder? B: who was in town then?’)

6 Grounding
I now show that the system can be fairly straightforwardly extended to deal with issues pertaining to utterance grounding. In order to do this, we need to focus on one particular view of what meanings and utterances are.

The answer I adopt is familiar within a view associated with situation semantics (see Cooper 1993 for explicit statement to that effect): a meaning

\textit{\textsuperscript{2}The insight behind this option is drawn from Carlson 1983, p. 101.}
is an abstract where the variables abstracted over correspond to the contextual parameters, whereas an utterance is refined as a situation, one that supports the various contextual facts needed to obtain a content from a meaning. In addition to which, an utterance will also support facts about its linguistic structure, analogously to the notion of sign in HPSG. For example: a simplified meaning for an assertoric use of

(22) Bill leaves

will be the abstract:

(23) \( \lambda b, a, s, u(\text{ASSERT}, a, (s! (\text{LEAVE} E, b))) \),

with the restrictions that \( u \models \langle \text{SPEAKER}, a \rangle \),

\( u \models \langle \text{DESCRIPTING}, a, s \rangle \), \( u \models \text{NAMED}, \text{'Bill'}, b \).

(Here \( u \) is a parameter for the utterance)

How to describe grounding? Given the notion of question described in the previous section, we have that an utterance \( u \) and a meaning of a sentence \( \mu \), serve to define a question \( q(u, S) = (u^? \mu) \) (‘the question which values the utterance situation \( u \) fixes the values of the contextual parameters of \( \mu \)').

\( u \) will be grounded if and only if there is a fact that the addressee knows and which resolves the question \( q(u, S) \) relative to her UNPUB-MS. In this perspective, Clark and Schafer's grounding criterion involves the utterer and addressee coming to be satisfied that the addressee knows an answer to the meaning question, specific enough for current purposes. In particular, once an utterance has been posed, if the stimulus is good enough for the addressee to recognize what sentence has been uttered, she realizes that the initial question under discussion is the meaning question.

How do we revise our original dialogue move rules to take these issues into consideration? The moves described previously will now be altered by composing any move that involves producing an utterance \( u \) of sentence \( S \) with a potential discussion sequence of \( q(u, S) \).

If DP1 makes a move that involves uttering, he does the usual things (updates QUD with 'whether p' for an assertion and q for a query.), but as topmost in QUD, he places \( q(u, S) \). The next stage is of course non-deterministic since it depends on DP2 receiving DP1’s stimulus and forming a correct belief about it. As a competent speaker what she is expected to do is this:

(21) If DP2 believes that \( S \) was uttered, she updates QUD with \( q(u, S) \).

Now what? She has two options.

* Ground \( u \): in this case, if DP2 believes she has information \( \psi \) that resolves \( q(u, S) \) relative to UNPUB-MS(DP2), DP2 removes \( q(u, S) \) from QUD; she adds the current content of LATEST-MOVE to FACTS; finally, she adds \( \psi \) to LATEST-MOVE.

Optionally, DP2 may utter an acceptance phrase for \( u \). The class of acceptance phrases, as a first approximation, might be described as follows: if \( u_1 \) is a constituent of \( u \), then if \( c_1 \) is an expression such that its content in the context of an acceptance is identical to \( u_1 \)'s content in \( u \), then \( c_1 \) can be used to accept \( u \).

This grounding protocol ensures that the previous content of LATEST-MOVE is added to FACTS, whereas LATEST-MOVE now contains information of the kind assumed in previous sections. DP2 will now react accordingly (accept or discuss an assertion, discuss or reject a query). In turn, if DP1 receives an explicit utterance acceptance phrase, he will use the QUD downstate principle to update his FACTS with the information characterising his utterance. Otherwise,

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3This slightly complex description is needed in light of the fact that indexicality ensures that not just any constituent of an utterance can be used felicitously to accept it:

(i) A: I left yesterday.
B: You/#I, hmm.

(ii) A: I'll put my plate here.
B: There/# here, ok.

For instance, 'the fact that A asserted that p'; whether 'that p' subsequently becomes part of FACTS is a completely different issue, of course.
since he does not receive a q(u,S)-specific utterance, he can do the same utilizing ASSUME.

- **Clarify u**: if the information DP2 possesses is not sufficient to resolve q(u,S), then she poses any question \( q_1(u, S) \) on which \( q(u,S) \) depends. In this case, \( q(u,S) \) is established in both QUD’s.

This option means, given the way querying sequences were constructed in section 4, that a side sequence will ensue, as will be discussed further in section 7.2.

With this apparatus in hand, we can return to provide a brief account of each of our motivating puzzles.

7 The puzzles revisited

7.1 Puzzle #1

I assume the existence of a rule of the following type for dealing with sentential modifier slice phrases exemplified by (1):

\[(25) \text{S} \rightarrow \text{XP} \]

\[\text{S (GB)} = ([XP], f), \text{ where } f \in GB|FACTS \land LATEST \land \text{MOVE} \]

This rule, which permits as argument for a sentential modifier slice any fact currently in the gameboard will, for instance, license a reading as in (26c) for (26b):

(26a) A: Bill likes Mary.
(26b) B: I see. Why?
(26c) Why does Bill like Mary.

The rule ASSUME can be utilized in such cases. For instance, in an example like (27a), A helps herself to what is not yet a common ground fact before B has had a chance to accept her assertion. This yields the resolution in (27b):

(27a) A: I claim that Mary left and I know why.
(27b) B: I claim that Mary left and I know why she left.

A discussion of the first puzzle that does justice to the full set of rather subtle facts underlying it cannot, unfortunately, be provided within the current space allotted. The following sketch will have to suffice. A, by uttering the first question in (1a), helps himself, using ASSUME, to the fact that a positive resolution of that question exists (in (1a): that the predicate ‘left the institute at 5’ is instantiated; in (1b) that Bill actually did buy that book for Mary.) Hence the availability of the resolutions in (3a,b).

B’s gameboard immediately after A’s query in (2a,b) is different: if she accepts \( q \) for discussion, she must do this by providing a \( q \)-specific utterance. In other words, by providing information about \( q \) or a question on which A’s question depends. Without doing this, she cannot help herself, as it were, to the fact provided by ASSUME once \( q \) is in QUD. Hence, the readings in (3a,b) are missing. Note that once B puts \( q \) into her own QUD, the reading becomes available:

(28) B: I think that Mary or Bill, but I’m not sure. I can tell you why though.

However, if B has managed to ground A’s utterance, the facts about the utterance she receives will make a resolution of the type in (4a,b) possible.

7.2 puzzle #2

The solution to this puzzle follows by applying the protocols for grounding and clarification described in section 6. The basic contextual change involved is this: in A’s moves, ((5c) and (5e)), ‘Cambridge’ and ‘History and English’ are used to provide information specific to the questions ‘which university [did B attend]’ and ‘what did B read [at university]’ respectively. A’s utterances license grounding moves by B whose import is, roughly ‘By uttering ‘Cambridge’/‘History and English’, a constituent of your latest utterance, I acknowledge that I understood that utterance.’

Explaining how clarification works is more interesting and intricate. The basic idea is simply this:
the questions expressed in (6d1) and (6f1) would be
included in the set of questions on which the mean-
ing question defined by the utterances in (5c) and
(5e) respectively depends. For a more detailed anal-
ysis of what utterances such as (6d1) and (6f1) mean
see section 4.4 of Ginzburg 1994b.

Here I will consider a somewhat simpler case: why
does (29a) license (29b) as a clarification:

(29a) Bill leaves.
(29b) WHO?

On an analysis of the content of echo queries as
in Ginzburg 1992, 1994a, (29b) gets a reading with
content:

(30) \((u?\lambda x(\text{ASSERT}, a, (s!(\text{LEAV E}, x))))\)

Given that the meaning question defined by (29b)
is (23), (30) is a \(g(u, '\text{Bill leaves'})\)-specific utter-
ance, ((23) is a question that depends on (30)) and hence
licensed.

7.3 Puzzle # 3

The explanation of this puzzle follows from consid-
eration of when Benito’s utterance can be assumed
grounded. The meaning question for a query use of
‘which button’ will be, roughly:

\[
(31) \ (u? \lambda P, a, s(\text{QUERY}, a, (s? \lambda x(P, x_{\text{button}})))
\]

(31), ignoring the speaker and situational par-
terms, can be paraphrased “What P is such that a
is asking which button P’s”. In order that the ut-
terance be grounded, (31) has to be resolved relative
to Alice’s UNPUB-MS, in which is represented what
she considers the goal of the interaction, say fixing
the destination they need to arrive in. What Benito
is after is for Alice to convey to him a fact \(\sigma\) that can
be characterised as follows:

1. \(\sigma\) is ABOUT the question Benito asks, namely
\((s? \lambda x(P, x_{\text{button}}))\)

2. \(\sigma\) entails the goal represented in UNPUB-
MS(Benito), relative to the inferential capabil-
ities encoded in UNPUB-MS(Benito).)

Any solution for \(P\) that provides it with a value
in accordance with the goal will do, as long as the
individual goals are compatible.

8 References

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