A NOTE ON PARTIAL MATCH OF DESCRIPTIONS: CAN ONE SIMULTANEOUSLY QUESTION (RETRIEVE) AND INFORM (UPDATE)?[1]

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Summary: In data base query systems there is an implicit assumption that descriptions in queries must match exactly, i.e., queries are for retrieval only, and not for retrieval and updating simultaneously. A related assumption (or constraint) that in questions descriptions are used referentially only (i.e., a question cannot be used simultaneously for questioning and informing) seems to hold in ordinary conversations also, with some qualifications. Some issues related to the validity of such a constraint and its relation to partial matching of descriptions are briefly discussed in this note.

1. In a question-answer system each description in a query is used referentially i.e., for each description one expects to find an entity in the data base which serves as the unique referent for that description. For simplicity, hereafter we will consider only definite descriptions (in particular, definite noun phrases consisting of a definite article, an adjective, and a noun). Thus in (1)

(1) Is the red book on the table?

the description the red book will serve to identify an entity, say, e_1 in the data base[2] and the description the table, an entity, say, e_2. The question can be answered after verifying the appropriate relation between e_1 and e_2. For the purpose of making the definiteness transparent and also for simplifying the discussion in this note, let us assume that there is exactly one book and one table in the data base.

2. The match for the red book can succeed if e_1 has a color attribute with the value red. The match can fail either due to a mismatch or a partial match. A mismatch will occur if e_1 has a color value other than red, say green. A partial match will occur if e_1 has an unspecified value for the color attribute or if the possession of the color attribute itself has not been specified for e_1.

In the rest of the discussion, we will not be concerned with failure due to mismatch, although many of the issues raised below are quite relevant to this case also. We will be concerned with partial matches only. A partial match really is

a partially successful match, where a part of the description has matched exactly, and the remainder has failed to match due to the lack of some information, and not due to a mismatch.

3. Let us consider the case of a partial match where the part of the description that matched is sufficient to identify the referent uniquely. In (?) this is trivially accomplished because of our assumption that there is exactly one book and one table in the data base.[3] Although we have a partial match (due to the lack of the color value or the color attribute itself for e_1), it will be possible to answer the question either by yes or no depending on whether e_1 is on e_2 or not, since the referents e_1 and e_2 have been uniquely identified. How should we proceed in this case?

1. If we insist that each description in the question must match exactly, then clearly, we have failed to establish a referen and the question cannot be answered.

2. On the other hand, we may assume that whenever we have a partial match and the referents are uniquely identified somehow, we should answer the question, and treat that part of the description which was not accounted for as new information. This new information can then be used to update the data base. Thus for the question (2), if the partial match is due to the fact that in the data base the value for the color attribute for e_1 is not specified, then we can now specify it to be red. If, on the other hand, the partial match was due to the fact that the possession of the color attribute itself is not specified for e_1, then the updating would involve adding a new attribute called color for e_1, and then specifying a value for it, which in is this case is red. The first type of update can be called content update and the second type, structure update; in the first case we have made a local modification of assigning a value to an attribute, while in the second case a new structural item has been added.[4]

4. There are a number of issues involved in adopting a strategy for updating upon a partial match when the matched part uniquely identifies the referent. We will state only two of these issues here and pursue the second in some detail.

a) The part of the description that was missing in the data base (and which led to a

partial match) is accepted as new information and used for updating. The strategy followed is that, if an exact match fails due to the lack of some information then the missing information is treated as new and updating is done accordingly. This is a kind of default reasoning.[5] However,,it is not clear whether we can allow such unconstrained updates. In data base query systems there is an implicit assumption that the descriptions in queries must match exactly, i.e., queries are for retrieval only[6] and not for retrieval and updating simultaneously. Can we relax this requirement somewhat? We can get some ideas by looking at questions in ordinary conversations, which is what we will do briefly in b) below.

b) The hypothesis (or constraint) that in a question construct[7] definite descriptions are used referentially only (i.e., a question cannot be used simultaneously for asking a question and conveying some additional information) seems to hold in ordinary conversations also, with some qualifications. The three examples below briefly describe some of the problems involved.

1) Suppose that \1) there is only one individual in the context, 2) the speaker believes that he is a plumber, 3) the hearer is unaware of his being a plumber, and 4) the speaker believes that the hearer is unaware of his being a plumber. Under such circumstances it would be inappropriate to use (3) to aske the question (4), and simultaneously inform the hearer that (5).

(3) when did the plumber leave?
(4) When did the person leave?
(5) He is a plumber.

If (3) is used by the speaker (possibly due to a mistaken belief that the hearer is aware that the person is a plumber), it is unlikely that the hearer will update his model without some clarification or some response such as Oh! I didn't know that he was a plumber, i.e., the hearer will not update without any interrupting responses. This example illustrates that the question construct cannot be used for questioning and informing simultaneously, and if it appears to have been so used (due to the speaker's ignorance of the hearer's lack of some information), the updating by hearer is not without an interrupting response, thus indirectly confirming the hypothesis.

2) Again suppose that 1) there is only one individual in the context, 2) the speaker regards him as a grouch, 3) the hearer has no such specific evaluation of him, and 4) the speaker believes that the hearer has no such evaluation. In this case, it seems not completely inappropriate for the speaker to use (6), in order to ask the question (7), and simultaneously inform the user that the speaker regards (8) to be the case.

(6) When did the grouch leave?
(7) When did the person leave?
(8) He is a grouch.

With evaluative information; simultaneously questioning and informing appears to be a bit more convenient. If (6) is used by the speaker, it appears that the hearer can update his model, without any interrupting responses, with the attribute grouchy attached to the entity, as speaker's evaluation (and the hearer's too if he agrees with the speaker). Even if the hearer asks for clarification, it is likely to be of the form Oh! I didn't know that you thought he was a grouch rather than Oh! I didn't know that he was a grouch (compare this to the response in the previous example).

3) Finally, there is an apparent violation of the hypothesis in examples such as (9).

(9) Who is sitting to the right of your lovely wife?

(9) can be used by the speaker to ask the question and pay a compliment (a side effect) rather than to convey new information. Thus the hypothesis does not appear to be violated in these cases.

5. Some of the issues which merit further investigation are as follows. 1) To what extent the hypothesis can be violated and what are the side effects. If the constraint is mutually understood by the speaker and the hearer, then any apparent violation of it will be recognized and may be accompanied by a side effect (implicature?) in addition to the updating. 2) To what extent updating without interrupting responses depends on the shape of the description, the syntactic construct in which it appears (e.g., questions, it-clefts, declaratives, etc,)[8], the role it plays in the construct (e.g., subject, topic, etc.), the discourse model (for the speaker and for the hearer) created so far, [9] etc. 3) To what extent the 'new' information used for updating has to be somehow relevant to the 'old' information, either by being inferrable from it or by being able to fit it into the discourse structure created so far, etc.[10]

Notes:

Some of the issues raised here will be discussed in detail in a forthcoming paper by Joshi and Rosenschein (Strategies for reference and ascription in object centered representations).

2. We will assume a rather simple-minded structure for the data base. It will consist of entities and attributes, and relations among entities.

3. However, in general, unique reference may be established due to the context, and the structure and content of the data base.

4. In the data base context, updates are usually content updates. Structure updates are not

permitted. In a conversational context and
discourse understanding, clearly, both types of
updates are possible. In these contexts it is not
clear whether we can always tell which type of
update has taken place. Structure updates should
be harder than context updates, cognitively
speaking, but this is only a conjecture at·this
time.

5. See "On reasoning by default" by Raymond
Reiter (this volume). The closed world assumption
discussed in this paper is also relevant to
our discussion. See also "Fragments of a theory
of human plausible reasoning" by Allan Collins
(this volume), and "Inferencing on partial
information" by Aravind K. Joshi, in Pattern
Directed Inference (ed. F. Hays-Roth and D.
Waterman), Academic Press. 1978.

6. See "Cooperative responses from a natural
language data base query system: Preliminary
report", by S. Jerrold Kaplan, Technical Report,
Department of Computer and Information Science,
University of Pennsylvania, November 1977.

7. We will limit ourselves only to wh
questions and yes/no questions.

8. Lorrie Levin has made a perliminary
investigation of the update potential of some of
these constructs (unpublished).

9. Entity-oriented discourse models have
been considered for problems of reference
(see "A·formal approach to discourse anaphora"
by Bonnie Webber, Ph.D. Dissertation, Harvard
University, 1978).

10. A detailed discussion of some of these
issues will be included in a forthcoming paper
by Joshi and Rosenschein (see note 1).