ON MODES OF DEFINITE REFERENCE: AN APPLICATION TO THE INTERACTION WITH DATABASE SYSTEMS

Genevieve Berry-Rogghe

Temple University, CIS Department; 03824
Philadelphia, PA 19122, U.S.A.

Identifying the referent of a singular definite term in a database query essentially consists in determining its extension in the database by applying the Russellian truth conditions for definite descriptions. However, most definite descriptions are "incomplete" in that the description itself does not contain the uniquely specifying conditions but it should be augmented by features derived from the situation or discourse context. Most work in AI in this field has concentrated on how to delimit the relevant contextual features (see, for example, the work on anaphoric reference and focussing by Webber 78, Sidner 77 and Grosz 76). This paper addresses certain aspects of the theory of definite reference which, though extensively treated in the literature on language philosophy, have been rather neglected in the design of natural language processing systems.

Some of the ambiguities of definite reference derive from the fact that a definite description may denote some unique individual in the world satisfying the specification or some individual the speaker has in mind who may or may not coincide with the former (ie the "referential" versus the "attributive" mode of reference). Furthermore, the speaker may intend the hearer to interpret the referring expression in either a "value laden" or a "value free" mode (cfr Barwise/Perry 80). In the former mode the sentence is given

a secondary interpretation by substituting in it the entity fulfilling the description. This raises such issues as to whether definite descriptions may be used to inform as well as to refer (see Joshi 78). The first part of the paper attempts to characterize the phenomena variously referred to by such terms as intension/extension, de dicto/de re, attributive/referential, value-free/value-laden... Some of these phenomena are to be accounted for on the semantic level of representation whereas others are deemed to belong to the pragmatic level.

The second part of the paper examines which of the modes of definite reference distinguished in part I are manifested in the interaction with a database system and how they can be recognized by the natural language interface. The standard procedure for definite reference identification is to exclude generic and "intensional" uses; to assume identity between the referent the speaker believes fulfills the description and the actual referent and to uniformly impose a value-laden interpretation mode. The following examples illustrate some other modes of reference which should receive adequate treatment in a natural language interface extending its capicity beyond the mere retrieval of factual information.

The generic mode of reference is not always obviously distinguishable from the attributive mode as shown by (1) and (2), respectively:

(1) How long is the flight from Boston to Chicago?
(2) How many passengers were on the flight from Boston to Chicago?

The semantic interpretation of the definite article in (1) corresponds to the universal quantifier whereas in (2) it corresponds to the iota-operator. In contrast to the generic mode, a definite description is used "intensionally" when the substitution of its extension in the sentence may alter the truth value. This is the case in referentially

opaque contexts. It has been pointed out by Kaplan/Davidson
81 that certain update commands such as (3) may be referent-
ially opaque:

(3) Change the teacher of CIS 234 to Dr. Smith.

The difference between the attributive and the referent-
ial uses, on the other hand, may be illustrated by the differ-
ent replies (4a) and (4b), respectively, to query (4):

(4) Is there a car parked under the big cherry tree?

(4a) No. There is no cherry tree in the scene.

(4b) Yes. But the tree you are referring to is an oak.

In the referential mode of reference the hearer has an
independent way of identifying the referent, usually through
locating him in time and space. In this mode the description
serves a dual function of referring and of describing. The
referential mode is only likely to occur when interacting
with a database consisting of visual objects displayed on a
screen (as in the SRI and HAM-RPM projects). In the attribut-
ive mode the description refers to whichever entity fulfills
the specification at a particular index. The referential/
/attributive distinction is not to be explained as a scope
ambiguity (cfr the re/de dicto readings) but rather both
readings should receive the same semantic interpretation, the
distinction being accounted for on the pragmatic level (see
further).

Of particular importance to natural language interaction
in a system that aims at a high degree of "cooperativeness"
is the distinction between the value-free and value-laden
interpretation modes, from the point of view of the hearer.
Consider the following alternative system replies (5a) and
(5b) to query (5). In (5a) the definite description was
value-laden, as is the standard practice, whereas the value-
-free interpretation indicated by (5b) seems to be more
appropriate to the user's intentions:

(5)   U: Does the head of the CIS department earn more
            than the head of the Philosophy department?
        S: Yes
        U: Why?
(5a)   S: Because Dr. Jones has more dependents than
            Dr. Smith
(5b)   S: Because computer science is better remunerated
            than philosophy

In order to retrieve the answer the extension of the
description has to be determined in both cases but in (5b)
the ingredients of the descriptive expression were retained
for further processing. This raises such pragmatic issues as
why a speaker chooses a particular description to refer to an
entity and what clues might guide the hearer as to the in-
tended interpretation strategy.

The third part of the paper gives an outline on how to
interpret these modes in the system. The approach taken is
that certain modes should be treated as pragmatic phenomena
rather than as semantic ones. At the semantic level a language
processing system should produce a context-independent inter-
pretation of what a speaker means by an utterance. The prag-
matic level deals with what the speaker intends the hearer to
infer from his utterance. At the semantic level of representat-
ion the Russellian truth conditions for definite reference are
applied, where appropriate. These determine the "semantic
referent" which is defined by the conventions of the language;
the "speaker's referent", on the other hand, is the object
which the speaker believes fulfills the conditions for being
the semantic referent (see Kripke 77). This paper attempts to
specify the notion of "speaker's referent" in terms of refer-
ence as a speech act. For example, a condition for felicitous
reference in the referential mode is that the speaker believes
that the referent satisfies the description and also that he
believes the hearer believes in the "justification" for the
description (cfr Cohen/Perrault 81). It will be shown that in

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certain contexts definite reference involves other speech acts
besides referring such as informing, describing, explaining...

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