THE GENERATION OF CONTINUOUS SEMANTIC CONSTRAINTS FROM SEMANTIC PROPOSITIONS

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Language comprehension is an exceedingly complex process which requires the extensive use of many different kinds of information in order to be successfully accomplished. One potentially *very* important type of information which has to date been largely ignored is the degree to which possible interpretations are sensible. While the sensibleness of candidate interpretations has long been recognized to be important, sensibleness has usually been treated as if it were an all-or-none property. However, it is clear that many things are more-or-less sensible and, therefore, the relative sensibleness of alternative interpretations may well be extremely useful information. For example, Oden (1977) has argued that degree of sensibleness information is required in order to disambiguate sentences to obtain the meaning that people normally do and has proposed language processing mechanisms which would use this information.

The degree of sensibleness of an interpretation depends on the degree to which the semantic constraints of that interpretation are satisfied. Therefore, to account for the continuous nature of sensibleness, semantic constraints must be fuzzy restrictions (Zadeh, 1975). A semantic constraint will be defined to be a function associated with a particular semantic relation which specifies, for *every* combination of semantic elements which may enter into that relation, the degree of sensibleness of the resultant semantic structure. The present paper outlines how such semantic constraints may be generated from the kinds of knowledge already represented in current semantic memory models (e.g., Norman & Rumelhart, 1975), plus the fuzzy predicates and operations which will be necessary in order to handle other problems like the continuousness of subjective class membership.

Defining semantic constraints to be functions makes it natural to think of complex semantic constraints as being compositions of simpler constraints. Furthermore, since semantic constraints are considered to be bound to particular semantic relations, the decomposition of a constraint may be expected to parallel the decomposition of its associated semantic relation. This appears to be what happens in most cases, but there are certain "configural constraints" which do not seem to be derivable from component constraints corresponding to primitive semantic relations (see Oden, 1977, for details). However, such configural constraints seem to be relatively exceptional and, consequently, semantic constraints will still be "cognitively economical." More importantly, it will be argued below that elementary (non-composed) semantic constraints, whether directly associated with primitive semantic relations or configural, are based upon specific semantic propositions which would be in semantic memory anyway.

In a fundamental sense, all knowledge is constraining. For example, knowing that it is -15° today affects the sensibleness of the statement "Maxine went swimming in Lake Mendota this morning." More generally useful knowledge specifies information about the normal and/or necessary properties of things which may enter into particular case relations with particular verbs. The most elementary knowledge of this sort (selectional restrictions) is often considered to be part of the basic meaning of the verb. However, the more interesting semantic constraints are those which are based on much less elementary knowledge, such as that only people normally drive trucks, which we might represent as:

$$drive(x,truck) \longrightarrow human(x).$$

The obvious interpretation of the constraint exerted by this knowledge is that it only makes sense for someone to drive a truck if that someone is human. However, I propose that in fact the constraint is that the degree to which it makes sense for someone to drive a truck is equal (assuming that all other constraints are satisfied) to the degree to which it is true that the person is human:

$$s(drive(x,truck)) = t(human(x)).$$

In general, it is proposed that knowledge of the form:

$$verb(x,y,...) \longrightarrow pred(x,y,...)$$

leads to corresponding semantic constraints of the form:

$$s(verb(x,y,...)) = t(pred(x,y,...))$$

that is, that the sensibleness of the proposition is equal to the degree to which the predicate is true for the specified arguments, where the predicate may be arbitrarily complex and may itself be decomposable.

In summary, it has been proposed (1) that semantic constraints are functions which specify the degree of sensibleness of semantic structures, (2) that complex semantic constraints are compositions of elementary semantic constraints and (3) that elementary semantic constraints are derived directly from knowledge about the expected properties of case nouns for particular verbs.

References

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