Pragmatics of the Semantic Web

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ABSTRACT
This paper is to challenge the basic assumptions about 'meaning' in the current technologies for the Semantic Web including RDF(S). The contextual and communicative aspects should not be ignored in the use of language. In this paper, therefore, the intensional semantics of the Semantic Web is examined along with conceptualist semantics as an alternative framework.

Categories
[**Challenge/position statements**]

Keywords
Pragmatics, nonmonotonicity, semantics, ontology, properties, concept.

1. INTRODUCTION
The Semantic Web is to create a Web where the contents of Web pages are "readable" or "understandable" for machines. The meaning of information must be explicitly expressed in terms of some semantic metadata language such as RDF for computer programs to "use" it. Extensive research has been conducted to build Web-based ontologies as key-enablers of the vision of the Semantic Web. An ontology is defined as an explicit specification of a shared conceptualization of a domain of interest [3]. For example, data represented in an RDF statement at the meta-level is supposed to specify a semantic value for a property of a resource. At the meta-meta-level, RDF schemas are intended to define property names in the form of a Web ontology that is used for a domain specific task.

This paper is to challenge the basic assumptions about 'meaning' in the current technologies for the Semantic Web including RDF(S). The intensional semantics that bases, for example, a model theory for RDF(S) assumes that the set of linguistic expressions is mapped onto a set of possible worlds and each particular world is called an *interpretation* [6]. Since the language on this view is treated as simple assertional language that relies on a strict monotonic principle, the contextual and the communicative aspects in the use of language are not taken into account.

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2. Intensional Semantics
The goal of intensional semantics is to provide truth conditions for the sentence in the sense that a *proposition* is defined as a function from possible worlds to truth values. The only primitive semantical elements of the model theory are possible worlds and their associated sets of individuals, and other semantical notions are defined in terms of propositions. On this view, a property is defined as something that relates individuals to possible worlds.

An RDF statement consists of a specific resource, which is an individual as a primitive semantical element, with a named property plus the value of that property for that resource. The basic RDF model is to represent named properties and property values [5]. A property is a rule to provide the meaning of the expressions which for each individual element specify the way the world should be constituted. The meaning of an expression in this approach, however, is independent of how individual users (humans or software agents) understand it.

The model theory for RDF assigns interpretations directly to the graph. An RDF graph consists of a set of triples of the form <Subject, Property, Object>, where Property is a URI reference, Subject as a resource is either a URI reference or a blank node, and Object as a value of the property for the resource is either a URI reference, a blank node, or a literal.

There is no such thing as 'the' one big RDF interpretation that completely asserts a constraint on a single possible world. On this view, however, the set of possible interpretations can be decreased as the size of a graph increases so that we will have less confusion in using the vocabulary defined by the RDF graph. An RDF interpretation is relative to a set of URI references in a graph in the sense that the ontological structure of URI references amounts to the dictionary of the vocabulary.

The intensional semantics of the Semantic Web hardly provides an account of how two separate RDF interpretations are related. As mentioned in [7], RDF(S) does not specify the actual ontology , but only provides multiple views into a single ontology. Each view represented in RDF(S) exists independently of any other views, and it is very difficult to build a single external ontology that all possible RDF interpretations are connected to.

3. Meaning and Communication

It was mentioned above that separate RDF interpretations are difficult to relate to each other. According to Harder [4], "the meaning of a linguistic expression is its (canonical, proper) communicative function." If RDF interpretations are determined by the state of the world, we cannot build software agents that are capable of linguistic communication. So an advocate of the alternative approach maintains that meanings are elements of the cognitive structure in the heads of the language users [2]. This kind of view on meaning is named the conceptualist approach.

The language users (humans or machines) conceptualize a category differently across situations. According to this view [1], as the category is encountered in different situations, a situated conceptualization should develop for each, linked together to make a combined concept. In other words, linguistic communication occurs when the conceptual structures of different views become attuned to each other. Since URIs in the RDF model theory are simple names, ignoring some important aspects of meaning, RDF does not provide any analysis of time-varying data or of changes to URI denotations [6]. In this sense, the intensional semantics of the current technologies for the Semantic Web does not provide a satisfactory way of modeling the dynamics of concepts.

4. The Conceptual Structure of Meaning

The basic unit of meaning in a model theory of RDF is a proposition that is represented in a sentential form as we see in the triple structure of an RDF graph. In conceptual semantics, on the other hand, lexical meaning is more fundamental than the meaning of sentences.

As mentioned above, a property in the intensional semantics of the Semantic Web is treated just a rule for grouping individuals by its value. However, a property and its values should be defined independently of possible worlds and individuals as a feature of individuals in virtue of which they may be grouped [2].

In the RDF documents, for example [7], the concept of "director" is a property in the Video schema but a class in the Artist schema. This reflects the fact that both a class and a property in a model theory of RDF are defined in terms of URIs that are only simple names.

Distinguishing between the notions of property and concept, Gärdenfors [2] holds that a property corresponds to a *region* of a conceptual space that is based on *one* dimension and a concept is described in *several* domains in terms of properties. For example, attributes represented in adjectives like "red" and "big" refer to a single domain such as color, while concepts represented in nouns like "apple" and "dog" normally contain information about several domains. On this view, the geometrical structure of the domains determines the meaning of a concept so that the similarity between concepts or between attribute values is well explained. The concepts and the properties are not independent of each other but can be structured into domains. For example, the meaning of a value of color property can be given only in terms of its relation to other values of color property.

In an RDF statement represented in a graph P(S, O), O as a property value is either a URI reference or a literal which is treated in a very rudimentary way without considering datatyping. Thus it does not afford any information of the relation between the values in the same range. Further research can be conducted to examine what extensions of the model theory are required to treat a property value as having a more complex conceptual structure.

5. Nonmonotonic aspects of meaning

Because it is basically impossible that we have complete knowledge about the real world, our conceptualization of a given object changes with additional information. If information about an object is *propositional*, on the one hand, an agent learns about new *facts* about the object, for example Tweedy is a penguin and thus does not fly. When the new information is *conceptual*, on the other hand, the agent *categorizes* the object in a new way, for example Tweedy is *seen* as a penguin instead of as just a bird.

There are many nonmonotonic aspects in general semantics that are not considered in this paper. However, it is important to note that nonmonotonic constructs should be included in the Semantic Web for the contents of Web pages to be really *interpretable* by machines navigating the dynamically changing ocean of information.

6. REFERENCES

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