Conceptualization in ideational theory of meaning: Cognitive theories and semantic modeling

Maziar Chitsaz\(^a\), Seyyed Mohammad Ali Hodjati\(^a\)*

*Tarbiat Modares University, Tehran, Iran

Abstract

The ideational theory of meaning is the theory according to which meanings of words are subjective ideas. In this article, we propose a visual modeling using Unified Modeling Language (UML) which, we believe, clearly represents the semantic of this theory. Additionally, we modify and extend classic ideational theory to provide answers to some of its defects, for instance, second-order concepts. We will show that our modeling is compatible with the cognitive theories about conceptualization such as hierarchical, network and prototype theory.

© 2011 Published by Elsevier Ltd. Selection and/or peer-review under responsibility of the 4th International Conference of Cognitive Science

Keywords: Ideational theory; meaning; UML; class; semantic; concept

1. Introduction

According to ideational theory of meaning, meanings of words are subjective ideas. This theory whose main defender (though not innovator) is Locke, is presented in Book II of An Essay Concerning Human Understanding (Locke, 1996) (to which we refer to by book, chapter and section number from now on). Locke defines "idea" as: "Whatsoever the mind perceives in itself, or is the immediate object of perception, thought, or understanding" (II, viii, 8). He divides ideas into two categories: simple and complex. By composition, comparison and abstraction, new ideas can be derived from existing ones. Most interpreters have agreed that two types of ideas must be distinguished: those based on direct perception, and those that are more abstract, called "Concepts" (Tomida, 2001, p. 8). Therefore concepts constitute a special type of idea. Although "idea" does not mean "image," Locke uses them interchangeably, for example, he says, the idea of sphere in the mind is like a circle (Locke, 1996, II, ix, 18). Some of the objections to ideational theory are due to this confusion. To distinguish concepts from each other, Nominal Essence is used. According to this theory, among attributes combined to construct a complex concept, we arbitrarily choose some of them as nominal essence. This could help us to identify objects and classify concepts (Lowe, 1995). These attributes provide the necessary and sufficient conditions to determine whether an object belongs to a...
category. Today, this theory of conceptualization is known as Classic theory and there are some new variations of it which are called Neo-Classics (Laurence & Margolis, 1999).

Locke's theory of ideas has many aspects and it is used as the basis his epistemology. Here, we leave aside epistemological and ontological aspects of Locke's theory and focus exclusively on its semantic features. By "semantic" we mean, the relation between words and ideas: "Words in their primary and immediate signification, stand for nothing, but the ideas in the mind of him that uses them" (Locke, 1996, III, ii, 2). Hence, in the ideational theory of meaning, words are signs of subjective ideas, not objects in the external world. However, words indirectly signify objects, because ideas are representations of objects (if there are any). So, "[t]hey often suppose their words to stand also for the reality of things" (III, ii. 5). Another important point is that Locke, like many early-modern philosophers (and we), has used "Signify" and "Mean" interchangeably (Dawson, 2007, pp. 14-17).

2. Semantic Modeling using UML

All notions that are used in the ideational theory of meaning can be represented by Unified Modeling Language (UML), which assists a better understanding of this theory. UML originally developed as a visual representation for software systems. We believe this modeling tool, not only visualizes the ideational theory, but also models most features of conceptualization in cognitive science. It also helps with analyzing some objections to ideational theory, and providing answers to them. Although our suggestion is that UML could be a good tool for semantic modeling, it must be noted it has not be designed for this purpose. Consequently, some philosophical considerations which are described below, seems indispensable.

"Class" is the main "Thing" in UML which is defined as: "Description of a set of objects that share the same attributes, operations, relationships, and semantics" (Booch, Rumbaugh, & Jacobson, 2005, p. 105). Two key points must be noted: 1) Class is not a set of objects, but description of the set. This discrimination helps us to mitigate some paradoxes of set theory. 2) This description could include both description of objects which are members of the set and description of the set itself. For example when we say Person has a Birthdate attribute, we mean that every person which this class connotes, has a Birthdate. However, if we say Person has a Count attribute, we do not mean that every person has a count. It is obvious that every person is just one person; Count attribute belongs to class, i.e., scope of this part of description of Person is classifier not instance. Classifier attributes differentiated by underline. Figure 1 shows Person class with three sample attributes (scope of one of them is classifier) and an operation.

Figure 1. A Simple Class

Simple concepts (ideas) can be represented by a class with no attribute or operation. According to ideational theory, a simple idea is: "... in itself uncompounded, contains in it nothing but one uniform appearance" (Locke, 1996, II, ii, 1). More abstract and complex concepts can be constructed by Abstraction and Composition. By abstraction, we separate particular ideas (of particular objects) from circumstances of real existence, such as time and place. Abstraction is used to construct a general idea which represents all instances of same kind. Composition is a mental process in which we compound several simple ideas into a complex one (II, ix, 6-7).

We use the terms Generalization and Association, instead of Abstraction and Composition respectively. Generalization is used in a broader sense: it is not only a process from particulars to universal ideas, but a kind of relationship which represent Is-A relation between two ideas. For example, although Male and Person are two different ideas, Person is a more general form of Male, therefore every Male Is-A Person. Likewise, association has
broader application of composition; in fact composition is a special case of association. We use association to represent any kind of conceptual relation between ideas, which is not necessarily compositional. For example, there is Marriage relation between Male and Female, but none of them are composed of the other one.

Some important notes about association must be considered. 1) Although Locke is not explicit, his examples of relations in Essay are binary relations. Notwithstanding in general, an association could be n-ary, n ≥ 1; an unary relation is a self-relation and a ternary relation is between three ideas. 2) Due to associations between classes, Accidental attributes are created, which are identified by Qualifier. For example, Person has Skin Color attribute because there is an association between Person and Color. Thus qualifier is a special type of attribute which is normally shown outside of class to emphasis its role and connection to association. 3) Associations may have attributes too. These attributes do not belong to either classes, but to association itself. For instance, if there is Buy association between Person and Car, Name attribute belongs Person and Color attribute belongs to Car, but Sale Date attribute belongs to Buy not to Person or Car. Figure 2 shows a simple sample about above notions.

Figure 2. Generalization and association between classes

This type of semantic modeling combines Hierarchical (Collins & Quillian, 1969) and Network (Smith, Shoben, & Rips, 1974) organization of concepts respectively. As a result, if we extend classic definition of concepts, i.e., a set of attributes, to a more sophisticated set (attributes, operations and relations), then relations between classes will be part of their meaning. This new version of ideational theory is more compatible with cognitive theories (Collins & Loftus, 1975).

As we mentioned in the introduction, in classic ideational theory, there is confusion between idea and image. Locke seems to think we have some Mental Image about some ideas; especially physical objects. In our model, their distinction is explicit, because concept of Dog represented by class and perception of a dog, represented by an object. In other words, a dog is an instance or object of Dog. In modeling Person as a class, only its attributes, operations and relations are important, but in modeling a person, attributes' value must be specified, at least for those attributes that we perceive directly.
Figure 3 shows an object whose attributes' values are specified.

![Figure 3](image)

**Figure 3. An object or instance or exemplar of a Person**

We suggest that Locke’s confusion about idea and image is due to Dual-Coding of our cognitive faculty. It appears that some of our ideas are represented by some kind of image (Kosslyn, 1990). Indeed, some (abstract) concepts must be represented in another way (Pylyshyn, 1984). Dual-coding theory, which combines these approaches, is the most favorable theory for our model because partly justifies the mixed use of "idea" and "image" in ideational theory. Hence, we could say that in an extended version of ideational theory, concepts are not just represented by classes; rather some instances of the class are components of its meaning. In cognitive literature these instances called Exemplar (Willingham, 2001). Each of these instances has its own attribute values, while all of them are instances of the same class. If only one object is used and its attribute values are set with typical values, we could call this special object, Prototype.

### 3. Benefits of Semantic Modeling

Modeling of ideational theory of meaning using UML, has several advantages. First of all, it is fully compatible with different theories of conceptualization in cognitive psychology (regardless of which one is better). Not only this modeling could represent each of those theories, but also it could be used with some combination of them. Secondly, it could clarify the fact that some objections to ideational theory are due to confusion about basic notions, such as attribute, attribute value and relation. These more philosophical points and advantages are elaborated in more detail below.

#### 3.1. Second-Order Concepts

Mental operations such as generalization and organization of concepts can be modeled as "Meta-Class" or "Second Order Class". Meta-class is a class whose instances are not ordinary objects, but classes. According to ideational theory of meaning, to have a meaning, every word must signify an idea. In that, "Horse is a Concept" has meaning if and only if (iff) "Concept" signify an idea as well as "Horse". The same is true about "Concepts may have Relation(s) to each other"; i.e., we must have an idea of "Relation", otherwise above sentence has no meaning. Concept is a meta-class whose instances are other classes like Horse. Relation is a meta-class whose instances are relations between lower level classes. Figure 4 shows that a Concept may have zero or more Relations with other concepts and might have been derived from other concepts; nevertheless a Relation must be related to at least one Concept. Pay attention to Multiplicity specified for each end of association, which indicates the number of instances of involved classes in those relations.

![Figure 4](image)

**Figure 4. Meta-Class for modeling mental operations and second-order concepts**
3.2. Berkeley's Objection

A famous objection to ideational theory was presented by Berkeley, who attacks the notion of idea (Berkeley, 1975, pp. 68). Berkeley asks what the idea of Person look likes. Is she Tall or Short? Is she Black or White? As noted before, in classic interpretation of ideational theory, every feature is an attribute, such as Being Tall. However by distinguishing attribute and attribute value, the problem will be resolved easily: Tall is not an attribute at all, instead Height is the attribute of a Person and each instance of this class may have a different value for that attribute. Of course some people whose Heights are above a certain value, could be characterized as tall; but when we want to model the concept of Person, we must note that Tall is not an attribute of class; rather a description about attribute value of an object.

3.3. Private Language and Communication

If mental ideas determine meaning, then language would be private. How can we compare our concepts with others? How communication is possible between people? When two person talk to each other and use the word "Bachelor", how they could be sure that they are refereeing to same concept? Arguments against and for private language are not considered here (for example cf. Craig, 2003). And it must be stressed that our semantic modeling provides no specific answer for this problem. But with visual modeling, the Locke's answer could be represented: Just check the attributes (and in our model operations and relations). As a result, speaker and listener can compare their concepts by comparing their classes. Hence similarity is enough for understanding and there is no need for identity of classes. According to this semantic, even similarity is not necessary for communication, although it is a must for understanding. For sufficient condition for communication is that the words that are used in communication signify classes in minds of speaker and listener, although it is quite possible that their words signify different classes. In such situations, misunderstanding will occur though communication could proceed. Therefore, the sufficient condition for communication is that words must signify classes and necessary condition for understanding is similarity of those classes.

It must be noted that simple concepts which have no attribute or operation, could not be compared, at least in this way (Locke, 1996, II, xxxii, 15). Locke's example which is called in today's literature as Inverse Spectrum is about two persons who perceive colors inversely (for example green and red). Locke admits they will never know the meaning of "Green" or "Red" for them are the same or different (II, xxxii, 15). Yet as long as they use these words in a similar way, they can communicate; for example if both use "Green" to refer to color of trees. However, according to ideational theory they have different meaning in their minds. In this type of comparison, class could not provide us with a clue, but objects of the class could. In other words, because we cannot compare what words directly signify (class), compare what they indirectly signify (object). Despite this, we must note that it is totally different from the Use Theory of meaning, for words' meanings are classes itself, not how we use them.

Above description could provide simple criteria for identity. 1) Two concepts are identical (even for one person) iff they have same sets of attributes, operations and relations. Namely, the concept of Single is different from Bachelor, for the latter has (at least) one more generalization relation with Male. As a more famous example in analytic tradition, we could think of Frege's example about different meaning (Sinn) of "Morning Star" and "Evening Star"; even these concepts (classes) signify the same object (Bedeutung) (Frege, 1970). 2) Two objects are identical iff they have same values for all their attributes. Semantically (but not ontologically), this criterion reminds us of Leibniz's principle: Identity of Indiscernibles. Subsequently if we cannot discriminate two objects, because all of their attributes have same value, we consider them to be identical, thought they might not be.

3.4. Barrier of Attributes

In section 0, it is explained that Locke divides ideas into two categories: simple and complex. A special kind of complex ideas is Substance which is barrier of compounded attributes. But what is this substance? Locke's answer is: "being nothing, but the supposed, but unknown support of those qualities" (II, xxiii, 2), "No clear idea of substance in general" (II, xxiii, 4). In other parts of Essay, Locke uses the term Substratum, in most cases for natural kinds, like gold. There is no clear distinction between substance and substratum (Bolton, 1976, p. 101) and there are some metaphysical aspects in both of them. For examples, some interpreters believe that substratum is a kind of micro-structure of physical objects (Ayers, 1998).

In our model, the barrier of attributes is nothing but an abstract entity, i.e., class. Unlike Locke, in this view, we do not need a physical or unknown entity (substratum or substance) for this purpose. In addition, a uniform semantic will be achieved for the natural and artificial kind. For, in the classic ideational theory, even if we accept Ayers interpretation about substratum, it could only be applied to natural kind like Lead (Locke's example). We believe
that our model in which class is considered as barrier of attributes, not only provides a simpler semantic, but also set aside metaphysical presupposition about natural kinds. It is also compatible with Essay, for it seems to us that Locke himself does not really believe in existence of special entity as substance: "we accustom ourselves, to suppose some substratum, wherein the do subsist, … we call substance" (II.xxii.1 emphasis from us).

3.5. Analyticity

It is widely accepted that the truth of some propositions are analytic, i.e., by virtue of the meaning, though some philosophers deny it (for most famous objection cf. Quine, 1980). Referring to Figure 2, "Every Person has a Birthdate" and "Every Male is a Person" are analytically true. Class diagrams not only represent and clarify what can be called analyticity by virtue of meaning, but could model what the meaning is for a person. For if we recall the definition of class, then the first sentence mentioned above, is true by definition. Additionally, relationships between classes are parts of the meaning of those classes, so by virtue of meaning of Male and Person, second sentence is true. Of course, this semantics could not answer why Male has a generalization relation with Person in one's mind, but if this is semantics model of those concepts in her mind, then it could be explain truth of above sentences in one's mind. Our position is similar to Katz's about inference of propositions (Katz, 1972).

4. Conclusion

We propose a semantics modeling of ideational theory of meaning using UML, a visual modeling tool which we believe could represent this theory clearly. Class as a new and modified version of Lockean idea, is the core component of this modeling which represents simple and complex concepts. It is new version of idea, for it does not include only attributes. Operations, relations and objects play an important role as its constituents. Words directly signify or denote classes and classes signify or connote objects. Therefore in this theory, words directly refer to class and indirectly refer to objects. According to ideational theory of meaning, direct reference of words is its meaning; hence we consider class as meaning.

Class diagrams represent conceptual organization of concepts. Generalization and association could model semantics of ideational theory, especially due to prominence of relation in conceptualization. Class diagram is compatible with famous cognitive theories about conceptualization, such as hierarchical and network model. Objects as instances of classes, represent exemplars and prototypes.

In addition, class and object as an enhanced version of idea, could response to some objections to ideational theory such as private language, barrier of attributes and Berkeley's objection. It also represents second-order concepts and analyticity.

References